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FOREST INSECT CONDITIONS IN THE UNITED STATES 1970

FOREST SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE

FOREWORD

This is the 21st annual report on the scope, severity, and trends of the more important forest insect infestations in the United States. It also summarizes the active programs undertaken by land managers to check resulting damage and loss. Although compiled primarily for public and private land managers to keep them abreast of insect conditions on their and neighboring lands, the report is also useful to students and others interested in forest insects and their effect on the environment. Volumes kept over the years serve as useful historical records of forest insect trends and occurrences of outbreaks.

Effective forest pest control programs require responsible administration and sound technology to discover and evaluate outbreaks. During 1970, 714 million acres of forest land were examined, both from the air and on the ground, by Federal Pest Control personnel to detect and appraise forest pest infestations. Twenty-seven States participated in the program, sharing in the cost of surveys and evaluation on non-Federal lands. Forest Pest Control personnel in the South are utilizing a time sharing computer system to assist them in expediting analysis of data collected during surveys and pilot control studies. This system helps reduce the time lapse between surveys and reports to the land manager. More important, scientists are freed for other pest control jobs.

Zectran, a rather selective nonpersistent carbamate insecticide, was officially registered for use against the eastern and western spruce budworm and jack-pine budworm. The label restricts the chemical to use by or under the supervision of the Forest Service. Zectran will be available for use in 1971.

The Forest Service and cooperating States continued to emphasize application of integrated control measures to reduce forest insect populations to manageable levels. More attention was given to determining the economics of control. During 1970, cost/benefit evaluations were made for the spruce budworm and the mountain pine beetle in lodgepole pine. Other major forest insects will undergo similar economic analysis.

Grateful acknowledgement is made to all Federal, State, county, and private agencies whose assistance and cooperation made this report possible. Special thanks is also given to entomologist James D. Ward, Southeastern Area, for his assistance in compiling the report. Comments on it are welcome.

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Forest Service
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Washington, D.C. 20250

F-521061

Cover photo: Tree defoliation (foreground) by the gypsy moth at High Point State Park, N.J., mars the beauty of the surroundings, reducing recreational values in this high use area (Courtesy NewJersey Department of Agriculture).

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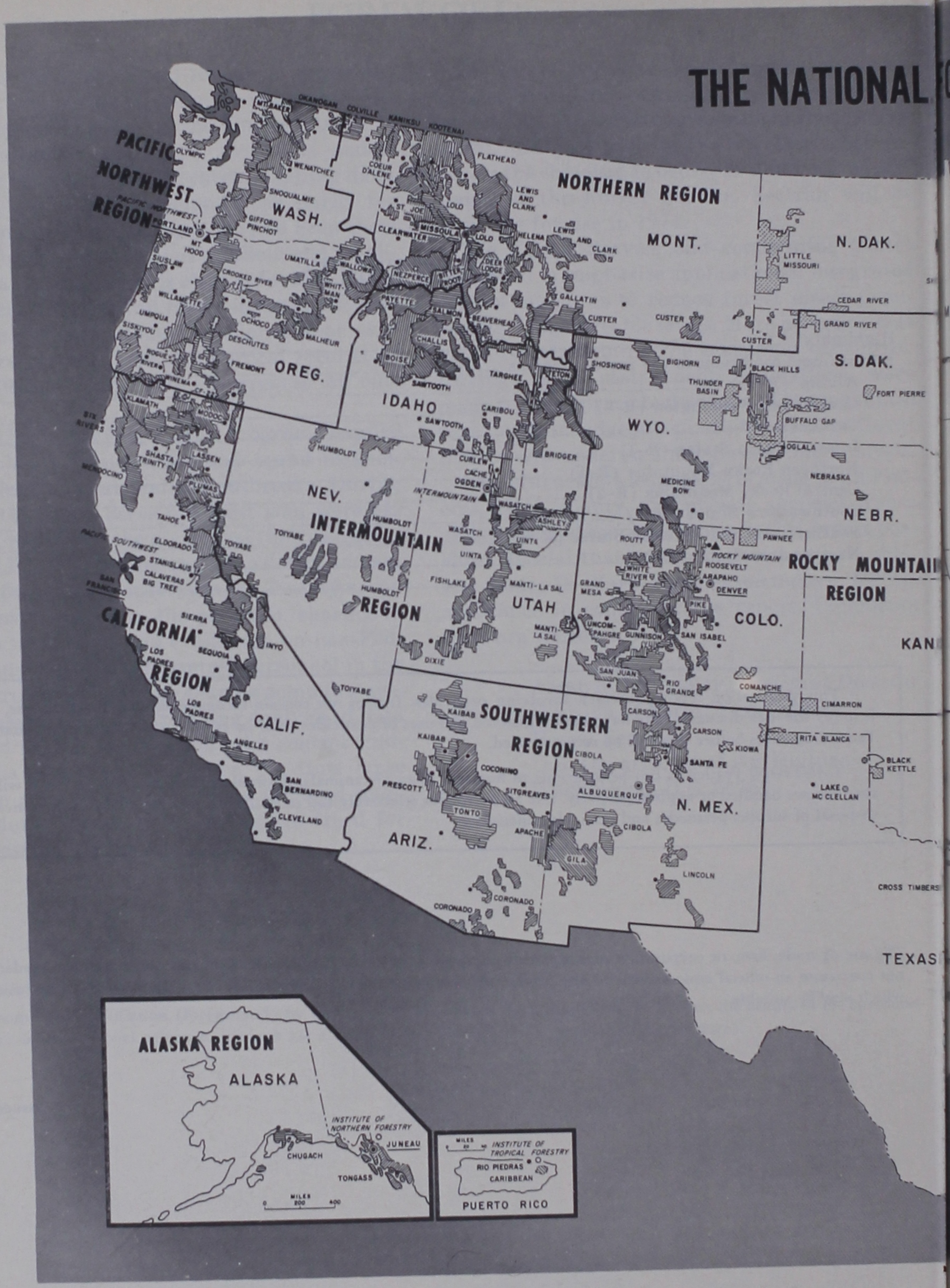
This publication reports research involving pesticides. It does not contain recommendations for their use, nor does it imply the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

CAUTION: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.

The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such does not constitute an official endorsement of any product or service by the U.S. Department of Agriculture to the exclusion of others which may be suitable.

Issued June 1971


THE NATIONAL
PACIFIC NORTHWEST REGION
PACIFIC NORTHWEST
PORTLAND
MT HOOD
OLYMPIC
MT BAKER
OKANOGAN
COLVILLE
KANIKSU
KOOTENAI
WENATCHEE
SNOQUALMIE
WASH.
GIFFORD PINCHOT
COEUR D'ALENE
FLATHEAD
NORTHERN REGION
ST JOE
LOLO
LEWIS AND CLARK
CLEARWATER
MISSOULA
HELENA
LEWIS AND CLARK
MONT.
DEER LODGE
BITTER ROOT
NEZPERCE
UMATILLA
WALLOWA
WHITMAN
CROOKED RIVER
SIUSLAW
WILLAMETTE
UMPQUA
SISKIYOU
ROGUE RIVER
OCHOCO
DESCHUTES
MALHEUR
FREMONT
OREG.
PAYETTE
SALMON
BEAVERHEAD
GALLATIN
CUSTER
CHALLIS
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WYO.
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BRIDGER
MEDICINE BOW
SIX RIVERS
KLAMATH
MODOC
SHASTA TRINITY
LASSEN
MENDOCINO
PLUMAS
TAHOE
ELDORADO
STANISLAUS
CALAVERAS BIG TREE
SAN FRANCISCO
PACIFIC SOUTHWEST
CALIFORNIA
REGION
SIERRA
SEQUOIA
INYO
LOS PADRES
CALIF.
ANGELES
SAN BERNARDINO
CLEVELAND
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CACHE
OGDEN
INTERMOUNTAIN
NEV.
INTERMOUNTAIN
REGION
WASATCH
ASHLEY
UINTA
TOIYABE
FISHLAKE
MANTI-LA SAL
UTAH
DIXIE
ROUTT
PAWNEE
ROCKY MOUNTAIN
ROOSEVELT
ARAPAHO
DENVER
WHITE RIVER
GRAND MESA
PIKE
UNCOMPAHGRE
GUNNISON
SAN ISABEL
COLO.
ROCKY MOUNTAIN
REGION
SAN JUAN
RIO GRANDE
COMANCHE
CIMARRON
KAN
KAIBAB
SOUTHWESTERN
REGION
CARSON
KIOWA
SANTA FE
RITA BLANCA
BLACK KETTLE
LAKE MC CLELLAN
CIBOLA
COCONINO
PRESCOTT
SITGREAVES
ALBUQUERQUE
N. MEX.
TONTO
APACHE
GILA
ARIZ.
LINCOLN
CORONADO
CROSS TIMBERS
TEXAS
ALASKA REGION
ALASKA
INSTITUTE OF NORTHERN FORESTRY
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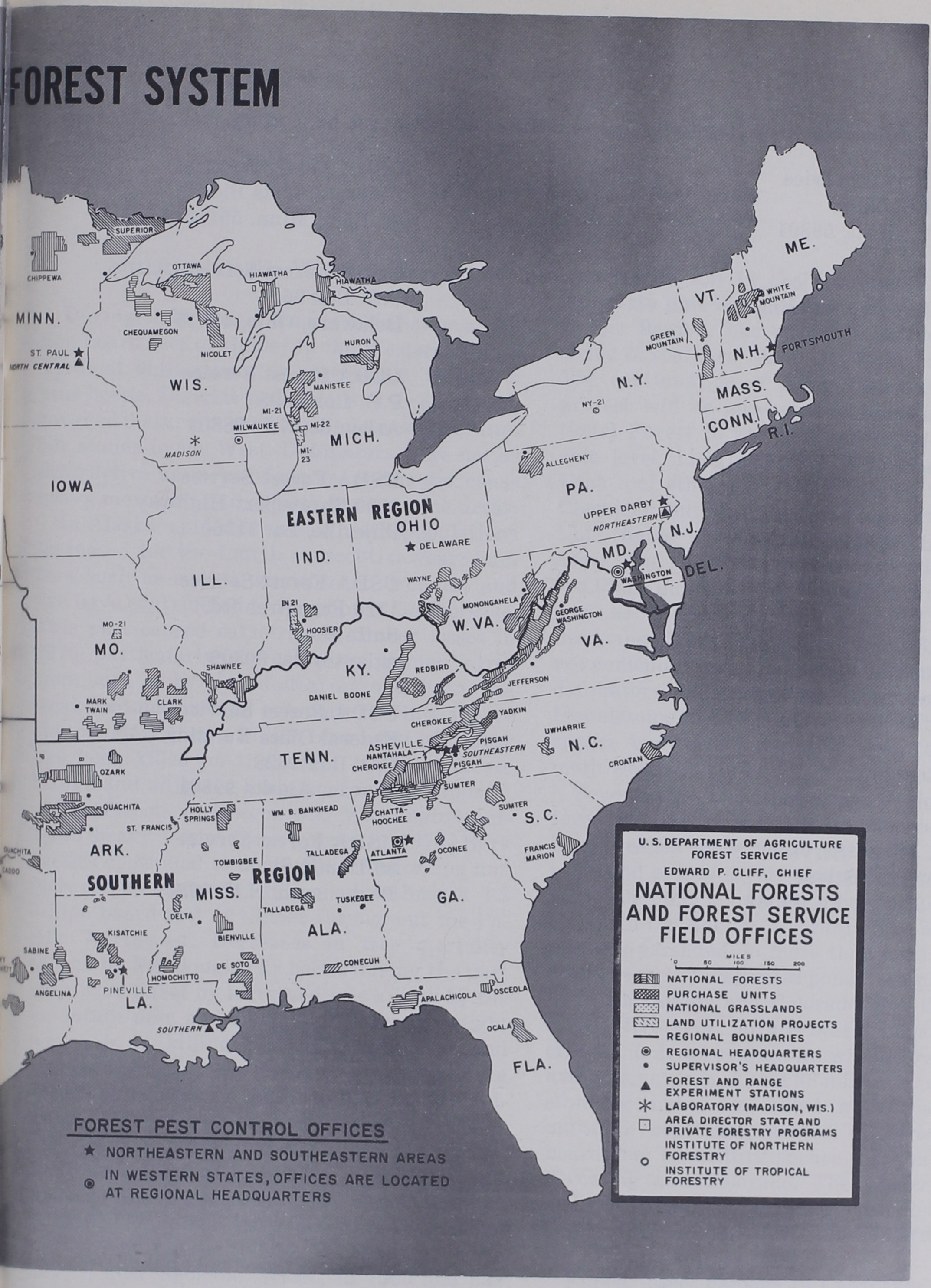
FOREST SYSTEM



U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
EDWARD P. CLIFF, CHIEF

NATIONAL FORESTS AND FOREST SERVICE FIELD OFFICES

MILES 0 50 100 150 200

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- PURCHASE UNITS
- NATIONAL GRASSLANDS
- LAND UTILIZATION PROJECTS
- REGIONAL BOUNDARIES
- ◉ REGIONAL HEADQUARTERS
- • SUPERVISOR'S HEADQUARTERS
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- ✳ LABORATORY (MADISON, WIS.)
- □ AREA DIRECTOR STATE AND PRIVATE FORESTRY PROGRAMS
- ○ INSTITUTE OF NORTHERN FORESTRY
- INSTITUTE OF TROPICAL FORESTRY

FOREST PEST CONTROL OFFICES

- ★ NORTHEASTERN AND SOUTHEASTERN AREAS
- ◉ IN WESTERN STATES, OFFICES ARE LOCATED AT REGIONAL HEADQUARTERS

Forest Pest Control offices are located at the following addresses; see map on pp. iv–v.

USDA Forest Service
Federal Building
Missoula, Mont. 59801

USDA Forest Service
Federal Center Building
Denver, Colo. 80225

USDA Forest Service
Federal Building
517 Gold Avenue S.W.
Albuquerque, N. Mex. 87101

USDA Forest Service
Federal Office Building
324 25th Street
Ogden, Utah 84401

USDA Forest Service
630 Sansome Street
San Francisco, Calif. 94111

USDA Forest Service
P.O. Box 3623
Portland, Oreg. 97208

USDA Forest Service
6816 Market Street
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USDA Forest Service
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St. Paul, Minn. 55112

USDA Forest Service
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Delaware, Ohio, 43015

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Asheville, N.C. 28803

USDA Forest Service
2500 Shreveport Highway
Pineville, La. 71360

USDA Forest Service
1720 Peachtree Rd.
Suite 800
Atlanta, Ga. 30309

USDA Forest Service
Federal Office Building
P.O. Box 1628
Juneau, Alaska 99801

USDA Forest Service
80 Daniel St.
Portsmouth, N.H. 03801

HIGHLIGHTS

Situation in the Western States

During 1970, forest insects killed several billion board feet of timber in the Western States. Virulent outbreaks of spruce beetle, mountain pine beetle, Douglas fir beetle, and fir engravers ravaged mature, overmature, and weakened timber stands in the West. Defoliators were not as destructive as in previous years but did cause heavy mortality and growth loss in some areas.

In Alaska, epidemic spruce beetle populations increased for the fourth consecutive year. Factors such as severe windstorms, drought, and fire have contributed to the population increase. This pest caused catastrophic timber losses in 1970, particularly in areas where human intrusion, such as by a land clearing operation, has weakened mature and overmature white spruce stands. More than a billion board feet of timber has been killed on the Kenai National Moose Range and adjacent State and private lands.

The forests in Oregon and Washington suffered heavy losses from insects in 1970. Bark beetles continued to dominate the situation and were responsible for killing an estimated 1.2 billion board feet of timber throughout the Pacific Northwest. Decreases in tree mortality caused by the Douglas fir beetle during the past year were offset by increased tree killing by the mountain pine and silver fir beetles and slight increases in killing by the fir engraver and spruce beetles. New infestations of western spruce budworm and western blackheaded budworm occurred after several years of light activity. Another defoliator, the larch casebearer, continued to spread in eastern Washington and was also found for the first time in northeastern Oregon. This insect, introduced into the eastern United States in the 1800's, first appeared in the Region near Spokane, Wash., in 1960 and has continued to spread since.

Bark beetles continued to dominate the forest insect situation in the Intermountain States. Mountain pine beetle activity decreased slightly in the Region, but epidemic populations persisted in southern Idaho and western Wyoming. The continuation of a large-scale suppression project will be necessary on the Targhee National Forest to keep timber losses at a tolerable level. Less severe outbreaks occurred in Utah and other parts of Wyoming and Idaho. Chemical control and logging of highly susceptible timber stands were carried on in several areas. The Douglas fir beetle epidemic in southern Idaho increased further in 1970. Infestations were so widespread in this area that salvage of dead and dying timber was the only measure recommended to reduce losses. Infestations of defoliators and other forest insects were less troublesome in 1970 than in 1969. The western spruce budworm and the Douglas fir tussock moth were the major defoliators in 1970.

Several forest insects continued to deplete the forest resources of the Central Rockies in 1970. Bark beetles were again the most important pests and caused severe timber losses in spruce, lodgepole pine, ponderosa pine, and Douglas-fir stands in the Region. Mountain pine beetle populations persisted on more than a quarter of a million acres of stagnated ponderosa pine stands in South Dakota and Colorado. For the second consecutive year, spruce beetle infestation increased in areas containing windthrown timber and logging slash. About 38 million board feet of standing timber was killed in 1970, and if the outbreak continues, several hundred million board feet of mature spruce may be killed in Wyoming and Colorado. The western spruce budworm regained outbreak status on the San Isabel National Forest in Colorado after declining to a low level in 1969.

Forest insect damage in California was at a tolerable level in 1970, but expanding populations of several major forest insects were de-

tected. Douglas fir beetle, which has remained relatively inactive since 1966, showed signs of increased activity on the Plumas and Six Rivers National Forests in northern California. Approximately 2 million board feet of timber was killed on these forests. The western pine beetle and the mountain pine beetle continued to infest weakened ponderosa pine stands in San Bernardino County. The discovery of a gypsy moth egg mass on wooden crates from New Jersey initiated an intensive detection program in San Juan Capistrano. Inspection for additional egg masses and other surveillance procedures will continue. Populations of another important defoliator, the Douglas fir tussock moth, began to increase after several years of inactivity. The largest infestation in 1970 covered several thousand acres on the Eldorado National Forest. For the second consecutive year, populations of the lodgepole needleminer increased in Yosemite National Park.

The forests of the Northern Rocky Mountains were attacked by a variety of insects in 1970. Several species of defoliators, particularly western spruce budworm, larch casebearer, and Douglas fir tussock moth, were active in the Region. Western spruce budworm defoliated about 4 million acres of forests, but populations continued to decrease in the Douglas-fir stands east of the Continental Divide and increase in Montana and Idaho. The larch casebearer extended its range in western Montana but caused only light defoliation in most areas. Mountain pine beetle populations increased in the Northern Rockies while spruce beetle, Douglas fir beetle, and fir engraver declined in most areas.

In the Southwestern States, epidemic spruce beetle populations continued to deplete the virgin spruce forests of the Mt. Baldy Wilderness Area and Fort Apache Indian Reservation in Arizona. More than 27 million board feet of spruce has been killed on the Reservation by this pest during the past 2 years. Epidemic populations of round-headed pine beetle infested 250,000 ponderosa pine trees on the Lincoln National Forest and Mescalero-Apache Indian Reservation in New Mexico in 1970. Defoliator populations were at low levels throughout most of the Region. Suppression of defoliators was required in several recreation areas.

Situations in the Lake and Central States and the Northeast

Defoliators remained the most troublesome forest pests in the Eastern Region. Twenty-five species of defoliators were active in this Region during 1970. Major defoliators included gypsy moth, forest tent caterpillar, large aspen tortrix, a red humped oakworm, and a complex of leaf rollers and tiers. More than 7 million acres of forest suffered defoliation from these pests in 1970 and most of the serious outbreaks are expected to continue in 1971.

The southern pine beetle, normally more of a problem in the South and Southeast, has caused serious timber damage in Maryland and Delaware. This outbreak extends into Virginia and is expected to continue in 1971. Balsam woolly aphid infestations increased in Maine but declined in New Hampshire. The beech scale and its associate fungus continued to cause widespread destruction of commercial-sized beech trees in New England.

Situation in the Southern and Southeastern States

A variety of forest insects was active in the Southern Region during 1970. Bark beetles as usual were the most important pests with infestations occurring in most southern States. Epidemic southern pine beetle populations in the Southern Appalachian Mountains were greatly reduced by extremely low temperatures during January of 1970. Populations remained at a low level in most of this area except on the Tusquitee District of the Nantahala National Forest and the Tellico District of the Cherokee National Forest.

Populations of ips engraver beetles continued to cause heavy tree mortality in the Hurricane Camille area of Mississippi and some mortality in areas of Louisiana, Texas, South Carolina, and Tennessee. Black turpentine beetle was also active in the Hurricane Camille area and caused heavy timber losses in the Sandhills of South Carolina.

Defoliators were more active in the Southeastern Area during 1970. Infestations of variable oak leaf caterpillar, forest tent caterpillar,

walkingstick, and various sawflies caused moderate to heavy defoliation.

Suppression Activities

Forest insect suppression programs were conducted throughout the United States during 1970. Major campaigns were directed against the southern pine beetle, mountain pine beetle, spruce beetle, saddled prominent, and spruce budworm and small-scale projects were waged against many less troublesome insects. Both public and private agencies continued to cooperate in suppression and pilot projects in the search for new and improved methods of forest insect control.

In the Western States, bark beetles were again the major target of control. Forest land managers continued to de-emphasize direct chemical control and rely more on alternative methods such as salvage, trap-tree, and burning infested trees; however, more than 400,000 trees were chemically treated for bark beetles during 1970.

The spruce beetle outbreak in Alaska is so large that salvage appears to be the only practical means of preventing timber losses. Even this method is not completely satisfactory, since an outlet for such a vast quantity of timber is not available.

The most vigorous suppression project in the West was directed against the mountain pine beetle on the Targhee National Forest in Idaho and Wyoming. Infestations were also reduced in Oregon and Washington by an aggressive precommercial thinning program.

In California, a synthetic sex attractant was tested for control of the Western pine beetle, and in the Southwestern States cacodylic acid-treated trees were evaluated as lethal traps for the spruce beetle. Further studies on both of these projects are planned for 1971.

In the Southern Region, nearly half a million trees infested by the southern pine beetle were salvaged or burned to suppress this pest. Only 56 pounds of BHC were used against the southern pine beetle in 1970.

Other significant suppression activities in this Region included a cooperative spray project in Virginia to control the fall cankerworm, and a release of cocoon parasites by the Virginia Division of Forestry and the Southeastern Forest Experiment Station to control the Virginia pine sawfly.

The largest defoliator suppression effort in the United States was directed against the spruce budworm in Maine. In this cooperative project, 211,625 acres were aerially sprayed with accothion. Satisfactory control was achieved, but the budworm population is expected to be high in this area again in 1971.

Other forest insects requiring suppression in the Eastern Region were the gypsy moth and saddled prominent, Saratoga spittlebug, orange-striped oakworm, Nantucket pine tip moth, pine bark aphid, and white pine weevil.

A summary of major pest control operations for 1970 is presented in the following tabulation:

Pest Control Accomplishments in the United States, 1970

Insect and location	*Trees Treated*	*Acres Sprayed*
Southern pine beetle—South and Southeast	474,531	------
Mountain pine beetle—Idaho, Utah, Montana, Colorado, South Dakota, Wyoming	277,485	------
Bark beetle[1]—California, Oregon, Washington	112,914	------
Spruce beetle—Colorado, Wyoming, Montana, New Mexico, Alaska	11,407	------
Roundheaded pine beetle—Nevada, Arizona	375	------
Saratoga spittlebug—Michigan, Wisconsin	------	5,425
Saddled prominent—New York	------	13,704
Fall cankerworms and leaf rollers—New Jersey, Virginia	------	2,220
Spruce budworm—Maine	------	211,625
Balsam woolly aphid—North Carolina	------	12
European pine shoot moth—Washington	74	------
Miscellaneous—entire United States	------	309
Total	876,786	233,295

[1] Reported in various combinations of western pine beetle, mountain pine beetle, ips and flathead borers, etc.

FOREST INSECT CONDITIONS IN THE VARIOUS REGIONS

ALASKA (R-10)

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Conditions in Brief

The spruce beetle continues to be the most important forest insect pest in Alaska. Epidemic populations are now active over a quarter of a million acres of white spruce type on the Kenai National Moose Range and adjacent State and private lands on the Kenai Peninsula. Scattered infestations in the south-central and interior portions of the State continue to cause light mortality in recreational areas and in stands adjacent to land clearing operations. Scattered blowdown resulting from a windstorm in October of 1969 is currently being infested on portions of the Chugach National Forest. The chronic infestations in the Caribou Creek and Tonsina River Drainages of south-central Alaska are declining. The persistent infestation in the Granite Creek Drainage of the Anchorage Ranger District has been significantly reduced by direct treatment. The anticipated spruce beetle buildup in windthrown Sitka spruce in southeastern Alaska did not materialize.

Defoliation by the hemlock sawfly was observed in many locations in southeastern Alaska from Frederick Sound southward to Moira Sound on the east side of Prince of Wales Island. An unexpected decline in western blackheaded budworm populations was observed in the Prince William Sound. Aphid populations were active at many locations in both south-central and southeastern Alaska. Populations of a saddleback looper at Connell Lake have declined without causing further damage. No projects were undertaken to control defoliating insects during the past year.

Status of Insects

Spruce beetle, *Dendroctonus rufipennis* (Kby.). Spruce beetle activity significantly increased in mature and overmature stands of white spruce on the Kenai Peninsula. A general zone of infestation extends almost unbroken for 60 miles from Point Possession to Clam Gulch. Two smaller outbreaks occur in the Deep Creek Drainage near Ninilchik and on the northwestern slopes of Bear Mountain in the vicinity of the 1969 Russian River Fire.

Epidemic populations are now active over a quarter million acres of white spruce type on the Kenai National Moose Range and adjacent State and private lands. Losses, including both dead and currently infested trees, are estimated at more than 1 billion board feet.

The infestations, except for the Pincher Creek-Point Possession outbreak on the north end of the Peninsula and the Bear Mountain outbreak, occur in areas where activities such as road building, general land clearing, habitat improvement, and petroleum exploration have been accelerated during the last decade.

These outbreaks are expected to continue. Tree morality will increase in areas of light to moderate infestation and is expected to spread into adjacent drought-weakened stands. Unless weather conditions change rather abruptly, most of the mature stands on the western half of the Kenai Peninsula will probably be "harvested" by this insect. Salvage logging of merchantable infested trees and large diameter green trees has been recommended. However, an outlet for a large quantity of logs is not presently available. No direct control is being considered at this time.

Blowdown on portions of the Anchorage and Kenai Ranger Districts, caused by a windstorm in October of 1969, is being infested. Ground surveys in the Sixmile River and Resurrection Creek Drainages and the Summit Lake area de-

tected a buildup of spruce beetle broods. The density of attacks was low and the infested trees were generally scattered. Favorable weather conditions during the summer of 1971 could result in the development of large beetle populations in these areas. No control is being considered at this time. However, it is recommended that concentrations of windthrown spruce be logged next season.

Examination of fireline construction debris and fire-damaged trees on temporary study plots within the perimeter of the 1969 Russian River Burn indicates that spruce beetle populations are developing in fire-weakened trees. This activity is expected to continue at least until the fire-damaged trees have been depleted. The ultimate course of this infestation will be determined by the amount of woodpecker predation and the type of weather that occurs over the next two seasons. Salvage logging is recommended. No trap-tree or direct control will be considered for at least one more season.

Scattered infestations in the south-central and interior portions of the State continue to cause light mortality in recreation areas and stands adjacent to land clearing operations. The low level infestations in the Caribou Creek and Tonsina River Drainages of south-central Alaska are declining.

Areas of chronic infestation were observed at various locations on the Chugach National Forest, but no new outbreaks were recorded. Direct control successfully reduced populations on a 60-acre infestation within a recreation area on the Anchorage Ranger District. Except for a small amount of maintenance treatment in campgrounds and recreation areas, no control projects are being planned for 1971.

A cedar bark beetle, *Phloeosinus squamosus* (Blkm.). Tree killing by this insect was commonly observed throughout southeastern Alaska from Kupreanof Island south to Portland Inlet. However, the number of newly fading trees was below that of the past 2 years. Additional mortality is expected in 1971.

Western blackheaded budworm, *Acleris gloverana* (Wlshm.), populations remained at endemic levels for the fifth season in southeastern Alaska. Defoliation was not observed during the aerial detection survey. However, budworm eggs were found at many sampling points south of Frederick Sound. Egg sample data indicate that populations are increasing on Revillagigedo Island near Ketchikan and at several locations on Prince of Wales Island. Elsewhere in the Prince William Sound, populations have unexpectedly declined following the spectacular buildup in 1969. Very little new defoliation was observed. Feeding within the 1969 defoliation centers was light and scattered. The results of larvae and pupae sampling indicated that populations within areas of both first- and second year feeding were low. The present population levels, compared with predictions based on extremely high egg counts in 1969 and 1970, are probably directly related to the cold, wet weather which occurred throughout the summer. Parasitism of 1969 pupal populations was low and no significant number of diseased larvae were observed in 1970. Unless favorable weather occurs during the summer of 1971, these infestations are expected to remain static.

A saddleback looper, *Ectropis crepuscularia* (D.&S.). Populations of a saddleback looper have returned to endemic levels following one season of feeding which produced moderate to severe defoliation and some mortality over 200 acres at Connell Lake. This rapid decline is related in part to the effects of pathogens observed in late larval instars last season and to heavy rainfall and cooler than normal temperatures which occurred during the moth flight in late May. This infestation is expected to remain at endemic levels in 1971.

Hemlock sawfly, *Neodiprion tsugae* (Midd.). Defoliation caused by the hemlock sawfly was observed in many locations in southeastern Alaska from Etolin Island south to Moira Sound on Prince of Wales Island. The degree of defoliation was quite variable, but generally light to moderate except for one area near Sunny Cover in the west arm of Cholmondeley Sound where heavy defoliation resulted in some top killing. Sequential egg sample data indicate that 1971 populations will be moderate to heavy in several locations in Cholmondeley Sound and at Connell

Lake on Revillagigedo Island. No control is being considered in 1971.

A noctuid defoliator. Large populations of an insect, tentatively identified as a species of the family Noctuidae, were recorded for the first time along Turnagain Arm on the Kenai Peninsula. This outbreak occurred over several hundred acres of State and private land on Bird Point, and resulted in moderate to heavy defoliation of a variety of noncommercial hardwoods. This infestation is expected to continue in 1971.

Cooley spruce gall aphid, *Adelges cooleyi* (Gill.). This aphid was active at many widely scattered locations in both south-central and southeastern Alaska. Several hundred acres of white spruce were infested near Kenai, Alaska. The extremely high populations produced large quantities of white cottony wax on the foliage of most trees, but caused little physical damage. The trend of this infestation is not known. No control is being considered.

Spruce aphid, *Elatobium abietinum* (Wlk.). Large populations of this aphid have caused moderate to severe defoliation and some tree killing on both Sitka spruce and planted ornamentals at several locations in southeastern Alaska. The most serious outbreak occurs in the vicinity of Sitka, Alaska on the Sitka National Monument and adjacent State and private lands. Tree mortality has occurred and more is expected unless cold winter temperatures reduce overwintering populations. A "standby" control project is being considered.

OREGON AND WASHINGTON (R-6)

By Leon F. Pettinger and Robert E. Dolph
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Conditions in Brief

Bark beetles remained the most destructive forest insects in the Pacific Northwest. Epidemic outbreaks killed an estimated 1.2 billion board feet of sawtimber. The mountain pine beetle and the fir engraver were the most destructive bark beetles. The Douglas fir beetle population is expected to increase in the wake of a severe ice storm in the Columbia River Gorge in January 1970.

Outbreaks of western spruce budworm and western blackheaded budworm reappeared after several years absence. The larch casebearer continued to spread and was found for the first time in Oregon. Populations of other potentially destructive defoliators increased slightly in both States.

Balsam woolly aphid outbreaks killed more true firs in recreational areas and timber production areas.

Status of Insects

Douglas fir beetle, *Dendroctonus pseudotsugae* (Hopk.). Outbreaks subsided in most areas of Oregon and Washington. In 1970, 7.2 million board feet of timber was killed as compared to over 121 million in 1969. In western Washington, scattered tree killing occurred on the Gifford Pinchot and Mt. Baker National Forests and on the Olympic National Park. In western Oregon, minor losses occurred on the Umpqua National Forest. In the east side Douglas-fir subregion, scattered losses occurred in north-central Washington and northeastern Oregon.

During January 1970, a freezing rain in the Columbia River Gorge damaged forest trees severely with accumulations of up to 1½ inches of ice. In the Little White Salmon River Drainage in Washington and the Hood River Drainage in Oregon, several thousand acres of timber were heavily damaged. Ground surveys showed that large numbers of beetles are building up in the storm-damaged trees and debris. Salvage of much of the material will lessen population buildups. Unfortunately, much of the damaged timber is either below merchantable size, or in restricted logging zones or inoperable areas.

The outlook during 1971 is for continued population buildups in the storm debris. By 1972, *rosae* (Hopk.), caused severe tree losses in many these areas.

Mountain pine beetle, *Dendroctonus ponderosae* (Hopk.), caused severe tree losses in many

pine forests of the Pacific Northwest. Losses in lodgepole pine stands increased sharply in Oregon but remained the same in Washington. In Oregon, over 676.4 million board feet of timber was killed on the Deschutes, Fremont, Malheur, Umatilla, Wallowa-Whitman, and Winema National Forests. These outbreaks are in overmature stands and are likely to continue for the next several years.

In western white pine stands in the Cascade Mountains, the beetle killed an estimated 350 million board feet of timber in Oregon and Washington. Over two-thirds of this volume is in wilderness areas, national parks, and other designated areas, hence, salvage operations will be minimal.

Outbreaks in pole-sized ponderosa pine stands decreased in both States. In Washington, 246,000 board feet was killed on 4,800 acres. These losses were mostly on the Deschutes, Fremont, and Wallowa-Whitman National Forests. An aggressive precommercial thinning program on National Forest land has helped to "beetle-proof" many areas.

Spruce beetle, *Dendroctonus rufipennis* (Kby.). Outbreaks increased slightly in Oregon and decreased in Washington. In Oregon, most damage occurred on the Wallowa-Whitman National Forest. In Washington, the most severe losses occurred on the Okanogan and Wenatchee National Forests. The estimated loss was 2.6 million board feet. Much of the loss, however, occurred on inaccessible or designated areas; hence, salvage operations will be minimal.

Fir engraver, *Scolytus ventralis* LeC. Heavy losses are still occurring from this beetle. Overall losses for this year were slightly higher than last year. Estimated loss for 1970 was over 138 million board feet. Most of the losses in Oregon occurred in the Blue Mountains on the Wallowa-Whitman and Umatilla National Forests. In Washington, the heaviest infestations were near Mt. Spokane in northeastern Washington and on the Colville National Forest.

Western pine beetle, *Dendroctonus brevicomis* LeC. Infestations in mature ponderosa pine stands increased in Oregon but decreased in Washington. Nearly 5.3 million board feet of timber was killed in both States. Heaviest losses occurred on the Ochoco and Deschutes National Forests in Oregon. Most damage in Washington was found on the Okanogan National Forest and on the Yakima Indian Reservation.

Pine engraver, *Ips pini* (Say). The amount of damage caused by this insect changed little from last year. Overall losses were minor and widely scattered. Most eastside forests received some damage. Reporting areas with the most damage were Fremont, Malheur, Umatilla, and Wallowa-Whitman National Forests in Oregon.

Silver fir beetles, *Pseudohylesinus* spp. Infestations of these beetles killed over 39.5 million board feet of true firs on the Mt. Baker and Olympic National Forests and the Olympic and North Cascades National Parks in Washington. No outbreaks occurred in Oregon.

Balsam woolly aphid, *Adelges piceae* (Ratz.) Outbreaks of this pest on true firs increased slightly this year. In Oregon, where the greatest increases occurred, most of the damage was found on the Mt. Hood, Umpqua, and Willamette National Forests. Losses in Washington were heaviest on the Gifford Pinchot, Snoqualmie, and Olympic National Forests and in Mt. Rainier National Park. The outbreak detected on the Olympic National Forest in 1969 is spreading rapidly. However, no infestations were found in Olympic National Park. Losses of Pacific silver fir near Mt. St. Helens on the Gifford Pinchot National Forest in Washington increased after several low years.

Larch casebearer, *Coleophora laricella* (Hbn.), infestations continued to spread. The insect was found for the first time in northeastern Oregon. On the Umatilla National Forest in southeastern Washington, where it was first found in very small numbers in 1967, populations are now high enough to cause light to moderate defoliation.

With few exceptions, all larch stands from north-central Washington to the Idaho border are now infested. In addition, considerable spread has occurred in the Blue Mountains of southeastern Washington and northeastern Oregon.

A survey of eight sites where the introduced parasite, *Agathis pumila* (Ratz.), was released showed the parasite had survived on six of the sites, but the degree of parasitism was very low —generally less than 1 percent. At these same sites, native parasitism as high as 20 percent was recorded. In general, native parasitism was higher where the casebearer has been present for several years.

Western blackheaded budworm, *Acleris gloverana* (Wlshm.). A sharp increase in western blackheaded budworm population occurred in western Washington. On the Olympic Peninsula, nearly 60,000 acres of western hemlock on the Olympic National Forest and Olympic National Park sustained light to heavy defoliation. On the Mt. Baker National Forest, over 8,000 acres were lightly defoliated. Sub-epidemic populations of

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Terminal defoliation caused by a grasshopper, *Melanoplus devastator* Scudd., on the Siskiyou National Forest in Oregon.

western blackheaded budworm were found at several localities throughout eastern Oregon.

Western spruce budworm, *Choristoneura occidentalis* (Free). After several years' absence, the population of this important defoliator is increasing. In the Imnaha River Drainage on the Wallowa-Whitman National Forest in Oregon, over 13,000 acres of Douglas-fir and true firs were lightly to moderately defoliated. On the Okanogan National Forest in Washington, one area of light defoliation of Douglas-fir and true firs was recorded. Elsewhere, subepidemic populations of budworm larvae were found in fir stands at several localities in eastern Oregon and Washington.

Other insects. A larch bud moth, *Zeiraphera improbana* (Wlk.), moderately defoliated western larch on limited areas of the Snoqualmie National Forest in Washington. Isolated stands of Sitka spruce along the Washington coast were defoliated by the spruce aphid, *Elatobium abietinum* (Wlk.). New infestations of the European pine shoot moth, *Rhyacionia buoliana* (Schiff.), were found in Centralia, Chehalis, Vancouver, and Spokane, Wash. Experimental tests of the insecticide, Guthion, were made against the shoot moth at McNary Dam, Ore. Preliminary indications are that Guthion will give adequate control in ornamental pines. The larch sawfly, *Pristiphora erichsonii* (Htg.), caused light defoliation of western larch on the Mt. Hood National Forest and Warm Springs Indian Reservation in Oregon. A Pandora moth, *Coloradia pandora* (Blake), caused light to moderate defoliation on ponderosa and lodgepole pine on the Deschutes National Forest in Oregon. Larvae of the Douglas fir tussock moth, *Hemerocampa pseudotsugata* (McD.), were common in survey collections throughout eastern Oregon, but no significant defoliation was found.

An infestation of a native shoot moth, *Eucosma sonomana* Kearf., was found on the Winema National Forest in Oregon. This pest mines the pith of terminal and lateral shoots of ponderosa, lodgepole, and Jeffrey pines, often damaging 50 percent or more of the trees in a stand. Resulting height growth loss may be as much as 30 percent a year.

Populations of a needleminer, *Coleotechnites* sp. near *milleri* (Busck), in the upper Deschutes Basin in Oregon subsided. The devastating grasshopper, *Melanoplus devastator* Scudd., caused some defoliation and twig killing at two Douglas-fir seed production sites on the Siskiyou National Forest in Oregon.

CALIFORNIA (R-5)

By John R. Pierce
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Conditions in Brief

Threatening populations of several forest insects were detected in California during 1970. The Douglas fir tussock moth occurred in significant numbers for the first time in several years; the Douglas fir beetle unexpectedly caused considerable localized tree killing on the Plumas and Six Rivers National Forests; a pitch midge weakened and deformed young ponderosa pine over much of the State; the lodgepole needleminer reached epidemic status in remote locations of Yosemite National Park and continued a serious increasing trend in valuable recreation areas of the Park; and an extremely damaging forest pest, the gypsy moth, was accidentally introduced into California. Despite these threatening conditions, observed damage from these and other insect pests remained for the most part at a modest or tolerable level.

Status of Insects

Douglas fir tussock moth, *Hemerocampa pseudotsugata* McD. Infestations of the Douglas fir tussock moth were detected at Burney Mountain, Siskiyou County; Iron Mountain, El Dorado County; Strawberry Peak, Tuolumne County; and Mariposa Grove, Yosemite National Park. The largest infestation covered several thousand acres on the Eldorado National Forest near Iron Mountain, while the most severe infestation occurred on a limited area of Yosemite National Park. Surveys of infested areas made

late in 1970 revealed the sharp increase in tussock moth numbers, but significant defoliation did not occur except in one small area of Yosemite National Park. If these infestations continue to increase, damage is expected to reach a serious level late in the 1971 season.

Research entomologists and forest insect control specialists are hopeful that a virus disease of the tussock moth can be used as a biological control agent. The outbreak area, on the Eldorado National Forest, is being studied by the Pacific Northwest Forest and Range Experiment Station to determine if the infestation has the characteristics that would permit a conclusive field evaluation of the virus spray.

Lodgepole needleminer, *Coleotechnites milleri* (Busck). The expected increase of the lodgepole needleminer epidemic in Yosemite National Park was confirmed by 1970 surveys. Serious defoliation of lodgepole pine stands occurred in "back country" locations of Virginia Canyon and Conness Creek. The strong increasing trend of moth numbers in more accessible and heavily used recreation areas also continued. Nearly all population sample plots showed increased numbers of larvae over the previous generation with the increases amounting to 200 to 500 percent in several cases. It now appears that only an abrupt shift in weather patterns or applied control can avert widespread defoliation during the next moth generation.

Gypsy moth, *Porthetria dispar* (L.). A viable egg mass of the gypsy moth was discovered at San Juan Capistrano on wood crating and pallets from New Jersey. The discovery was made by the USDA Agricultural Research Service's Plant Protection Division in September. All of the suspected infested material was burned on the site and the area thoroughly sprayed with carbaryl. Inspection for additional egg masses in the area will continue. Neighboring sycamore and oak trees will be closely watched for larvae in the spring. In addition, sex-lure traps to attract adult males will be used next summer.

Sawflies, *Neodiprion* spp. Sawfly damage was relatively common on pines and firs in 1970. Most of the reports came from Siskiyou and Modoc Counties in the northern part of the State. However, sawfly defoliation was also nearly always present in areas where the Douglas fir tussock moth was active. Surveys planned for the winter will be used to evaluate the sawfly infestation in one or two of the more important locations.

Other defoliators. Several hardwood defoliators were active during the year. The fruittree leafroller, *Archips argyrospilus* (Wlk.), defoliated nearly all of the oak trees and some understory Douglas-fir over approximately 100,000 acres along the northern shores of Shasta Lake in Shasta County. The fall webworm, *Hyphantria cunea* (Drury), defoliated madrone and alder trees in spots throughout the northern part of the State. The satin moth, *Stilpnotia salicis* (L.), was again reported feeding on aspen in Modoc County; an ash bug, *Neoborus pacificus* Van D., severely defoliated shade trees in Camptonville in Yuba County; and the California oakworm, *Phryganidia californica* Pack., damaged oaks in several areas but was particularly noticeable in the Anderson Valley of Mendocino County. The epidemic of a brown day moth, *Pseudohazis eglanterina* (Bdv.), that severely damaged sheep range in Inyo County in 1969, collapsed in 1970.

During 1970, no direct control efforts were carried out to combat forest defoliators other than the gypsy moth.

Douglas fir beetle, *Dendroctonus pseudotsugae* Hopk. Spontaneous outbreaks of the Douglas fir beetle killed an estimated 1 million board feet of overmature Douglas-fir timber on the Plumas National Forest in Plumas County, and another million board feet on the Six Rivers National Forest in Humboldt County. The Humboldt County infestation is centered on Tish Tang Ridge, where this beetle inflicted devastating losses in 1966. The current outbreak may wipe out mature trees in that area. Evaluation of these outbreaks indicated increasing trends for next year. Control has been carried out, or is planned for this winter, by logging infested trees.

Western pine beetle, *Dendroctonus brevicomis* LeC. The western pine beetle continued killing

trees in several well-known problem areas and scattered spots around the State such as McCloud Flats, Siskiyou County; Bass Lake, Madera County; and Basket Pass, Kern County. Population trends of this beetle were closely studied at Bass Lake and found to be static at a low level. This confirmed the general endemic character of western pine beetle activity in the northern part of the State during the year.

In southern California, this beetle is partly responsible for a high mortality rate of ponderosa pine at Lake Arrowhead and Barton Flats in San Bernardino County. Serious air pollution damage to the trees is probably the primary cause of the problem. Additional damage from this beetle is expected on drought and fire damaged trees.

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Collecting and identifying insects associated with the western pine beetle in California.

During 1970, an extensive and detailed field test was conducted at Bass Lake to evaluate the newest tools and techniques for the detection, study, and control of the western pine beetle. Involved in the test were: (1) The use of traps baited with recently developed synthetic attractants for this beetle, and (2) color-aerial photographs taken periodically for the purpose of monitoring bark beetle populations over a sizable forested area. The test was a cooperative project involving personnel from Pacific Southwest Forest and Range Experiment Station, University of California, Regional Office and Sierra National Forest, California Division of Forestry, Stanford Research Institute, Pacific Gas and Electric Company, and the Pines Civic Council. Results of the tests are not available at this time.

Mountain pine beetle, *Dendroctonus ponderosae* Hopk., infestations increased in locations where host vigor was impaired by ecological factors. This occurred in the 38-year-old overstocked ponderosa pine plantation at Sugar Hill in Modoc County and in an overage and overstocked lodgepole pine stand near Independence Creek, Sierra County. Thinning was recommended for control. In the lodgepole pine stands around urbanized districts in the southern Lake Tahoe area, mountain pine beetle damage increased where scale insects weakened many trees. A persistent, endemic population of these beetles also is killing groups of lodgepole pine in the upper Tuolumne and Merced River Drainages of Yosemite National Park where mature trees still suffer from the lingering effects of past needleminer defoliations.

In San Bernardino County, an increasing population of mountain pine beetles is present in ponderosa pine stands where host vigor has been impaired by smog.

Other bark beetles. Other bark beetle species causing concern in local areas include engraver beetles, *Ips* spp., reported from most pine areas of the State; fir engraver, *Scolytus ventralis* LeC., reported from Siskiyou, Lassen, Alpine, and San Bernardino Counties; Douglas fir engraver, *S. unispinosus* LeC., Siskiyou County; red turpentine beetle, *Dendroctonus valens* LeC., Siskiyou, Trinity, Placer, and Madera Counties; Jeffrey pine beetle, *D. jeffreyi,* Hopk., San Bernardino, Fresno, and Inyo Counties; and various twig beetles reported from pine, juniper, and oak from Plumas, Humboldt, Nevada, Tulare, and Butte Counties. The California flatheaded borer, *Melanophila californica* Van Dyke, continued to be epidemic in the Laguna Mountains of San Diego County. Fire-damaged pine trees in the Laguna Mountains area are expected to be highly susceptible to attack by this beetle. Salvaging these trees was recommended to prevent increases in this epidemic.

A pitch midge. *Cecidomyia piniiopis* (O.S.). Flagging of branch tips of young ponderosa pine trees in plantations and natural stands by the midge was the most widespread and conspicuous forest insect damage observed during 1970. Infestations were reported from Fresno County northward to Siskiyou County near the Oregon border. In plantations where severe twig killing occurred, counts of up to 40 larvae in individual twigs were found. In nearly all cases, affected trees are expected to recover with little permanent damage or growth loss unless the infestation becomes chronic in character. Early field checks of the current overwintering midge generation indicate the infestation is continuing but at a reduced level.

Other insects damaging plantations and young trees. The grasshopper, *Bradynotes obesa* (Thomas), again infested newly established plantations in the Mt. Shasta and Doe Peak areas of Siskiyou County. The USDA Agricultural Research Service treated 275 acres with carbaryl, and 500 acres with malathion to control these outbreaks. Another grasshopper, *Oedaleonotus tenuipennis* (Scudd.), severely damaged a smaller plantation on Frazier Mountain in Ventura County.

Sapsucking insects. Three established and damaging outbreaks of scale insects were under observation and study during 1970. The epidemic of pine needle scale, *Phenacaspis pinifoliae* (Fitch), present in the town of South Lake Tahoe for the past 3 years, shows evidence of declining as natural parasites and predators build up in

the population. This beneficial increase in natural enemies has resulted from a change in mosquito abatement programs. Spraying is now directed against mosquito larvae in the water, rather than in the upland areas to kill the adults. The sprays directed against mosquito adults in the past had inadvertently killed most of the natural enemies of the scales.

Damage from a pinyon needle scale, *Matsucoccus acalyptus* Herb., continued on 24,000 acres of arid pinyon pine type in Ventura and Kern Counties. Recently discovered infestations were present at Cactus Flats, San Bernardino County and Pinyon Flats, Riverside County. The same insect has also damaged sugar pine in Siskiyou County.

Ground application of dimethoate spray to protect 585 pinyon pine trees on several recreation and administrative sites was accomplished successfully in 1970.

INTERMOUNTAIN STATES (R-4)[1]

By William H. Klein and Lawrence E. Stipe
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Conditions in Brief

Bark beetles continued to be the most destructive forest insects in the Intermountain Region. The mountain pine beetle population in lodgepole pine, less extensive than last year, remained epidemic in portions of southern Idaho and western Wyoming. The most destructive outbreak was in the Targhee National Forest where 218,000 standing trees were chemically sprayed to reduce losses in a timber sale area. In adjacent Yellowstone and Grand Teton National Parks, epidemic conditions persisted. Tree losses increased again this year on both divisions of the Bridger National Forest.

Less extensive infestations either developed anew or already existed in other parts of southern Idaho and Utah. Mortality in ponderosa pine stands caused by this beetle remained at about the same level as last year.

The Douglas-fir beetle population, already at a high level, increased even more in 1970. Tree killing of serious proportions continued in southern Idaho with heaviest losses occurring on the Boise, Payette, and Sawtooth National Forests. Because the infestation is so widespread, control is not feasible.

Defoliators and other forest insects were less of a problem in 1970 than in the previous year. The western spruce budworm remained epidemic on the Payette and Bridger National Forests but no tree killing occurred. Damage to Douglas-fir by the Douglas-fir tussock moth increased significantly in southwestern Idaho, while defoliation of lodgepole pine by a sugar pine tortrix decreased.

Status of Insects

Mountain pine beetle, *Dendroctonus ponderosae* Hopk., continued to deplete the lodgepole pine forests of the Intermountain Region, but tree losses were well below the high level of recent years. The most serious infestation in 1970 was on the Targhee National Forest in Idaho and Wyoming and in Yellowstone National Park in Wyoming. This infestation continued to exert pressure on the Warm River timber sale area where a 3-year suppression effort has been under way. In 1970, over 218,000 trees were individually treated on 120,000 acres. Plans are to remove 150 million board feet of timber from this area in a 5-year period. South of the sale area, the infestation has slowed down due to lack of host material, but to the east in Yellowstone National Park, tree killing continues at an accelerated rate.

Elsewhere, different conditions exist. The once damaging infestation on the Teton National Forest has almost completely subsided, but in adjoining Grand Teton National Park epidemic conditions continue. The Park is now experiencing a resurgence of beetle activity following the early termination of suppression in 1967. On the Bridger National Forest, in both the Wyoming and Bridger Divisions, the beetle continues to push southward into uninfested stands. Logging in and ahead of the infestations to salvage infested trees and those ultimately threatened is the only feasible method of control.

[1] Includes forested lands in Utah, Southern Idaho, Western Wyoming, and Nevada.

In southern Idaho, on the Payette and Sawtooth National Forests, several new infestation centers in lodgepole pine stands were detected. A resurgence of tree killing has occurred on State and private lands south of McCall, Idaho. Widely scattered outbreaks of varying intensities continue on portions of the Caribou National Forest, Idaho; Cache National Forest, Idaho and Utah; and the Ashley and Wasatch National Forests, Utah.

On a lesser scale, tree killing of ponderosa pine continues in widely separated areas. The long-standing infestation in second-growth stands on State and private holdings east of Cascade, Idaho, continues to spread, but has yet to reach National Forest lands. Concern is for esthetic and recreation values in Bryce Canyon National Park and Flaming Gorge National Recreation Area, Utah, where scattered mortality of mature and overmature timber continues. In Bryce Canyon National Park, the situation is considerably more serious because most of the infestation centers are visible from the main highway.

Douglas fir beetle, *Dendroctonus pseudotsugae* Hopk. The serious infestation that was triggered by winter storm damage throughout southern Idaho more than 5 years ago showed no

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Storms during winter of 1968-69 seriously damaged this Douglas-fir stand on the Targhee National Forest, Idaho, making it highly susceptible to bark beetle infestation.

indication of subsiding. Tree killing of severe proportions has occurred in portions of the Boise, Payette, and Sawtooth National Forests, and to a lesser extent on the Challis and Salmon National Forests in Idaho. The infestation is so widespread that control by other than natural means is simply not possible. The only alternative is to salvage as much of the dead and dying timber as possible.

Winter storms in 1968–69 caused widespread damage which provided favorable breeding material for the beetle on the Ashton District, Targhee National Forest, Idaho. Although some of the debris contained broods, the extent of standing tree attacks will not become evident until spring of 1971.

Regional personnel, in cooperation with Boyce-Thompson Institute, conducted a study to test the attractiveness of a synthetic pheromone, frontalin, to inflight beetle populations. All baited trees were attacked as were most of the nearby unbaited trees. Only 8 percent of the check trees were attacked. In this respect, the project was deemed an unqualified success. The problem now is to develop new methods of testing that will qualify this attractant as a practical survey or control tool.

Western spruce budworm, *Choristoneura occidentalis* Free., infestations on the Payette National Forest in Idaho, and Bridger National Forest in Wyoming, were the only important infestations.

Infestation boundaries widened on the Payette National Forest but decreased on the Bridger National Forest. Defoliation on both Forests was, for the most part, light to moderate with some heavy defoliation occurring in very limited areas. Egg mass surveys, however, indicate increases in both intensity and extent of these infestations in 1971. No control is planned.

Spruce beetle, *Dendroctonus rufipennis* (Kby.), damage was widely separated and confined to high elevation spruce stands in the northern part of the Region. Most of the outbreaks resulted from storm and avalanche damage. The heaviest concentration of spruce activity was in the upper reaches of Huntington Creek, Manti-LaSal National Forest, Utah. Logging is now under way to salvage some of the dead and dying timber in the Hilgard Mountain infestation, Fishlake National Forest, Utah.

Roundheaded pine beetle, *Dendroctonus adjunctus* Blandf., continued to kill mature and overmature ponderosa pine in stands on the Las Vegas Ranger District, Toiyabe National Forest, Nev. Efforts have been made to reduce tree killing in summer home sites and recreation areas by felling and spraying or removing infested trees, but the infestation is too widespread to achieve anything but very local control.

Douglas fir tussock moth, *Hemerocampa pseudotsugata* McD., populations continue to fluctuate in mature Douglas-fir stands on Bureau of Land Management, State, and private lands in Owyhee County, Idaho. Natural factors which held the population in check for the past 2 years failed to prevent a sudden increase in 1970. Heavy or complete defoliation occurred in several localized outbreaks southwest of Silver City. Relatively heavy egg deposits point to heavy defoliation in 1971.

A sugar pine tortrix, *Choristoneura lambertiana* (Busck), damage is at its lowest level in several years. Only one infestation was visible from the air and that was in pole-sized lodgepole pine on the Targhee National Forest, Idaho.

A leaf blotch miner, *Lithocolletis* sp. Heavy populations of this minute insect caused premature defoliation of Fremont cottonwood in Zion National Park, Utah. Detailed observations show that this leaf miner has two generations a year. Efforts are now in progress to learn something of the insect's life history and habits.

A pinyon needle scale, *Matsucoccus acalyptus* Herb. A mild winter presumably was partly responsible for triggering increases in previously endemic populations of this scale in widely separated areas of Nevada. Moderate to heavy defoliation on Christmas-tree size pinyon pine occurred in localized outbreaks on the Humboldt and Toiyabe National Forests. Control was not undertaken.

Other insects. The lodgepole terminal weevil, *Pissodes terminalis* Hopp., continues to kill terminal leaders of lodgepole pine reproduction in widely separated areas in the Region. Damage to standing trees by the pine engraver, *Ips pini* (Say), is at its lowest level in several years. A leafminer, *Argyresthia* sp., caused heavy defoliation of incense cedar near Lake Tahoe, Nev. An increase in the sighting of pine butterfly moths, *Neophasia menapia* (Feld. & Feld.), in portions of the Boise and Payette National Forests may indicate an upsurge in feeding damage in 1971. For the first time in 6 years, populations of a tent caterpillar, *Malacosoma incurvum discoloratum* (Neumoegen), on Fremont cottonwood in Zion Park, Utah, were low enough that they did not require control. Widely scattered tree killing of ponderosa pine by the western pine beetle, *Dendroctonus brevicomis* LeC., continues in two areas on the Dixie National Forest, Utah. Gambel oak along the Wasatch Front, Utah, was only lightly defoliated by a looper, *Lambdina punctata* (Hulst). Boxelder was heavily defoliated by *Archips negundanus* Dyar in portions of northern Utah and southern Idaho.

NORTHERN ROCKY MOUNTAINS (R-1)[2]

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Conditions in Brief

A variety of insects damaged forests in the Northern Region during 1970. The western spruce budworm caused varying degrees of defoliation on approximately 4 million acres of Douglas-fir and mixed conifer types. Budworm infestations continued to decline in pure Douglas-fir forests east of the Continental Divide and intensified in the mixed coniferous forests of western Montana and northern Idaho. Larch casebearer continued to spread and invade new areas in western Montana. The intensity of infestations remained at relatively low levels in Montana. Mountain pine beetle infestations continued in western white pine forests on the Kaniksu and Flathead National Forests and increased considerably in ponderosa and lodgepole pine stands on the Lolo, Helena, and Gallatin National Forests in Montana and in lodgepole pine stands in Yellowstone National Park, Wyo.

Tree killing by the spruce beetle and Douglas fir beetle remained at low levels during 1970. Fir and pine engraver populations continued to decline over most of the Region, but localized infestations persisted in several areas. A pine looper severely defoliated ponderosa pine near Lame Deer and Ashland, Mont. for the second consecutive year, but heavy parasitism and disease infection of mature larvae caused the outbreak to collapse. Pine engraver beetles infested and killed a high proportion of the severely defoliated pines.

Status of Insects

Western spruce budworm, *Choristoneura occidentalis* Free. Total budworm defoliation remained around the 4-million-acre mark of 1969 although infestation boundaries have changed somewhat. Budworm activity continued to be light on the forests east of the Continental Divide except for an area of moderate to heavy defoliation on the Deerlodge National Forest, Mont. The greatest decline in budworm activity was on the Bitterroot National Forest, Mont. The size of this infestation was not greatly reduced but the intensity of defoliation decreased considerably. The budworm population on the Nezperce National Forest, Idaho, remained highly active with over a million acres defoliated. Increased tree mortality was noted in 1970, especially along the South Fork of the Clearwater River. Nearly all fir and spruce stands on the Nezperce National Forest are infested. Infestations have increased in size and intensity on the Lolo National Forest, Mont., and the Clearwater and St. Joe National Forests, Idaho. The infestation on the St. Joe National Forest was first visible on 2,000 acres in 1968. It spread to 15,500 acres in 1969 and to 28,000 acres in 1970.

[2] Includes forested lands in Montana, northeastern Washington, northern Idaho, North Dakota, northwestern South Dakota, and National Park Service land in northwestern Wyoming.

The trend for the Region followed the pattern of the past 4 years. Defoliation decreased in the pure Douglas-fir stands of eastern Montana and increased in the high value mixed conifer stands of western Montana and Idaho.

Larch casebearer, *Coleophora laricella* (Hbn.). During 1970, heaviest casebearer defoliation occurred on the lower elevations of the Colville National Forest in Washington and the Kaniksu, Coeur d'Alene, St. Joe, and Clearwater National Forests in Idaho. The larch casebearer continued to expand its range and invade larch stands in western Montana. Populations, however, are at low levels for most areas in Montana except near Flathead Lake and along the Idaho border.

Tree mortality and branch dieback have not spread to new areas. Many trees are showing signs of recovery in damaged stands where casebearer populations have declined.

The introduced parasite *Agathis pumila* (Ratz.) was recovered from 58 percent of the release sites sampled in 1970. Parasitism by *A. pumila* averaged 63 percent in one of the original 1960 release sites but was less than 10 percent in 25 of the 33 areas where *A. pumila* was recovered. Native parasites *Dicladocerus* sp. near *westwoodii* Westwood and *Spilochalcis albifrons* (Walsh) continued to be abundant throughout the Region.

Mountain pine beetle, *Dendroctonus ponderosae* Hopk. Infestations continued in western white pine in Lightning Creek, Kaniksu National Forest, Idaho. Infested trees are being removed by commercial sale. Additional infestations occurred in western white pine near the Upper Priest River, Kaniksu National Forest, and along the South Fork of the Flathead River and Hungry Horse Reservoir, Flathead National Forest, Mont.

A massive infestation was detected in ponderosa pine stands in Ninemile Creek, Lolo National Forest, near Missoula and adjoining State and private lands. An estimated 96,000 trees are currently infested on 6,000 acres.

Infestations in lodgepole pine stands near St. Regis, Mont., on the Lolo National Forest and adjoining State and private lands intensified during 1970 and spread over a gross area of 12,000 acres despite control efforts. Additional control work is planned.

Approximately 1,400 infested ponderosa pines were felled and burned in Lincoln Gulch on the Helena National Forest near Lincoln, Mont., during early 1970. Additional infestations were detected later in the year in Lincoln Gulch and nearby Park, Stonewall, and Liverpool Creek Drainages. An estimated 2,500 trees were infested by mountain pine beetle in this area. Control operations, consisting of removal of infested trees by commercial sale and hand piling and burning, are under way.

Epidemic mountain pine beetle populations occurred in lodgepole pine stands in the West Gallatin Drainage, Gallatin National Forest, Mont., and the perimeter of infestations in lodgepole pine stands in Yellowstone National Park expanded significantly. Several large group kills detected in lodgepole pine stands on the west slopes of the Continental Divide in Glacier National Park were attributed to the mountain pine beetle.

Localized group kills by the mountain pine beetle occurred in ponderosa pine on the Flathead Indian Reservation and the Bitterroot and Lewis and Clark National Forests, Mont. Infestations near Monarch Mountain, Lewis and Clark National Forest, declined to endemic levels.

Spruce beetle, *Dendroctonus rufipennis* (Kby.). Tree killing by the spruce beetle was at a low level throughout the Region. All infestations declined to an endemic status as a result of unusually low temperatures during the winter of 1968–69. Chemical treatment of 150 trees effectively suppressed populations in the Jewel Basin, Flathead National Forest, Mont.

Salvage logging continued in spruce beetle killed stands on the Flathead and Kootenai National Forests, Mont., and the Kaniksu National Forest, Idaho. Tree losses are expected to be low in 1971.

Douglas fir beetle, *Dendroctonus pseudotsugae* Hopk. Tree killing by the Douglas fir beetle declined in 1970. Logging slash was heavily infested during 1970 along Tyler Creek east of Missoula on the Lolo National Forest, Mont.

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Mountain pine beetle infestation near Lincoln, Mont. Light colored crowns are ponderosa pine killed by beetles.

There are groups of trees throughout the Tyler Creek-Gold Mountain area which were attacked in 1970 and contain active populations. Salvage logging for removal of dead trees is planned.

Pine engraver, *I. pini* (Say), killed ponderosa pines in groups of up to 50 trees along the South Fork of the Clearwater River on the Nezperce National Forest, Idaho. Increased pine engraver activity was detected in ponderosa and lodgepole pine stands near Hayden Lake, Coeur d'Alene National Forest, Idaho. The infestation level declined in ponderosa pine forests along the Clark Fork River west of Missoula where losses have occurred for several years.

Localized pine engraver activity occurred in the Sleeping Child Drainage, Bitterroot National Forest, Mont., and in the Blacktail Mountains of the Flathead Indian Reservation. *I. pini* was commonly associated with mountain pine beetle infestations in western Montana. Infested lodgepole pines near St. Regis, Mont. contained higher brood densities of *I. pini* than *D. ponderosae.*

A six-spined engraver, *I. calligraphus* (Germ.), caused severe losses in ponderosa pine stands which already suffered heavy infestation by a pine looper, *Phaeoura mexicanaria* (Grote), on the Ashland District, Custer National Forest and the Northern Cheyenne Indian Reservation near Lame Deer, Mont. An infestation level of 72 trees per acre was recorded on Cook Mountain on the Ashland District.

Fir engraver, *Scolytus ventralis* LeC. Prolonged periods of drought during 1966 and 1967 triggered outbreaks of this beetle throughout the grand fir type of northern Idaho. Tree killing declined during 1970, but some localized activity continued. Aerial detection surveys in 1970 revealed infestations west of the Salmon River and in the Meadow Creek Drainages, Nezperce National Forest, Idaho, and near Powell, Idaho. Scattered infestations occurred on the Coeur d'Alene National Forest, Idaho, and west of Plains, Mont. No control operations were planned, but some salvage logging was started.

A pine looper, *Phaeoura mexicanaria* (Grote), seriously defoliated ponderosa pine on the Northern Cheyenne Indian Reservation and the Ashland District of the Custer National Forest in eastern Montana for the second consecutive year. The infestation spread from about 25,000 acres in 1969 to about 62,000 acres in 1970. Defoliation varied from light to complete stripping of the foliage. Trees of all size and age classes were equally damaged.

Heavy looper mortality began to occur in late summer from competition, parasites, and disease. No live looper pupae were located during the fall, indicating that the infestation had collapsed.

The epidemic was short-lived (2 years) and no trees have been found that died directly from the defoliation. However, defoliation was severe enough to predispose many of the trees to attack by ips engraver beetles, and thousands of trees have been killed by them.

Pine butterfly, *Neophasia menapia* (Feld. and Feld.), activity increased in ponderosa pine stands on the Bitterroot and Lolo National Forests, Mont., during 1970. Defoliation could be observed from the ground for the first time this year. An abundance of eggs indicated a potential increase in 1971 populations.

Douglas fir tussock moth, *Hemerocampa pseudotsugata* McD. Until 1970, there had been no evidence of tussock moth activity in the Region since the epidemic of 1965. Several isolated ornamental spruce were defoliated in Spokane, Wash., and in Polson and Missoula, Mont., during 1970. This may be the first indication of renewed activity by this insect pest.

Deloliator complex. A sugar pine tortrix, *Choristoneura lambertiana* (Busck), pine needle sheathminer, *Zelleria haimbachi* Busck, an unidentified needleminer, and the pine needle scale, *Phenacaspis pinifoliae* (Fitch), caused heavy defoliation of lodgepole pine on approximately 3,000 acres from the east side of Teakettle Mountain near Columbia Falls, Mont., to the Flathead National Forest northeast of McDonald Lake in Glacier National Park. The sugar pine tortrix heavily defoliated ponderosa pine on State and private lands in Three Mile Creek adjoining the Helena National Forest,

F–521035

Engelmann spruce terminal killed by the Engelmann spruce weevil, Flathead National Forest, Mont.

Mont. The tortrix and the pine needle miner confine their feeding to current year's growth, and the needleminer mined only older foliage. Scale populations were distributed throughout the infested area, but appeared heavier on the east side of Teakettle Mountain. Heavy defoliation is anticipated for 1971.

Engelmann spruce weevil, *Pissodes engelmanni* Hopk., caused top killing of spruce reproduction throughout spruce forests in Montana, Idaho, and in Yellowstone National Park.

Heaviest leader killing occurred in a young plantation in Emery Creek on the Hungry Horse District of Flathead National Forest. Repeated attacks resulted in complete mortality of 50 sapling size spruce in this plantation since 1967. Damage is expected to continue.

Cone and seed insects. Approximately 12,000 Douglas-fir and 500 ponderosa pine cones were collected during 1970 and evaluated for insect injury. Douglas-fir cones were collected from 13 locations throughout Montana and Yellowstone National Park. An average of 56 percent of the Douglas-fir cones were visibly deformed due to insect feeding. The most damaging insects on Douglas-fir cones were the western spruce budworm, *Choristoneura occidentalis* Free., which infested 33 percent of the cones examined; cone and scale midges, *Contarinia oregonensis* Foote and *C. washingtonensis* Johnson, which infested 21 percent of the cones; Douglas-fir cone moth, *Barbara colfaxiana* (Kft.), which infested 21 percent of the cones examined; and a fir coneworm, *Dioryctria abietella* (D.&S.), which infested 14 percent of the cones.

An average of 33 percent of the ponderosa pine cones collected from six locations in Montana were visibly deformed. The most injurious insect on these cones was a pine seedworm *Laspeyresia* sp. which infested 97 percent of the cones at one location. Other insects found to be important were coneworms, *Dioryctria* sp. and *Dioryctria auranticella* (Grote), a midge, *Contarinia* sp., and a cone bug, *Leptoglossus* sp.

Other insects. Two species of needle midges, *Contarinia pseudotsugae* Condr. and *C. constricta* Condr., caused light damage on Douglas-fir near Kalispell, Mont. These midges extensively damaged Christmas-tree plantations by mining the foliage and causing gall formation on the current year's needles. The variable oakleaf caterpillar, *Heterocampa manteo* (Dbldy.), caused extensive defoliation of hardwoods on the Fort Totton Indian Reservation and in the Killdeer Mountains, N.Dak. Secondary infestations of the western pine beetle, *Dendroctonus brevicomis* LeC., occurred in ponderosa pines infested by *Ips pini* (Say) on the South Fork of the Clearwater River, Nezperce National Forest, Idaho. A small group kill attributed to *D. brevicomis* was detected in ponderosa pine on the Lolo National Forest, Mont. A bark beetle, *Pityokteines minutus* (Sw.), killed several hundred subalpine fir in two drainages on the Flathead National Forest, Mont. Infestations of a terminal weevil, *Pissodes* sp., caused top kill of lodgepole pine saplings on the Flathead National Forest and Glacier National Park. Approximately 20,000 acres of birch were defoliated by the birch skeletonizer, probably *Bucculatrix canadensisella* Chamb., along the Lochsa River in Idaho.

CENTRAL ROCKY MOUNTAINS (R-2)[3]

By Donn B. Cahill and C. Kendall Lister
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Denver, Colo.

Conditions in Brief

Bark beetles continued to be the primary forest insect pests in Region 2. Spruce beetles killed about 38 million board feet of standing timber in 1970 and threatened to kill an additional several hundred million feet of mature spruce. The mountain pine beetle killed 100,000 ponderosa and lodgepole pine. Timber losses are expected to decrease in stands of ponderosa pine and increase in lodgepole pine stands.

Defoliator activity has increased. Western spruce budworm activity has increased moderately on the San Isabel National Forest and remained endemic in other previously infested

[3] Includes forested lands in Colorado, Kansas, Nebraska, South Dakota, and Wyoming.

areas. A defoliator complex of sugar pine tortrix, a needleminer, and a pine top moth caused light to moderate damage to ponderosa pine in southwestern Colorado. Lodgepole terminal weevil heavily damaged sapling stands on portions of the Roosevelt and Routt National Forests.

An integrated control program has been initiated for bark beetles. This program will include salvage and logging, supplemented with a trap-tree program and chemical control directed against the spruce beetle. Chemical control and logging are also being used against mountain pine beetle outbreaks.

Status of Insects

Spruce beetle, *Dendroctonus rufipennis* (Kby.), became an increasingly serious problem in mature spruce stands. In the Region, timber losses caused by spruce beetle were estimated at 75,000 trees on 26,000 acres. Epidemic populations built up in windthrown trees and green logging slash. The San Juan National Forest had epidemic beetle populations on three Ranger Districts that contained about 50,000 infested trees on 15,000 acres. An infestation near Four Mile Creek contains 4,000 trees in the San Juan Primitive Area.

The Medicine Bow National Forest conducted active salvage, logging, and trap-tree programs to control an infestation of 7,000 infested trees on about 800 acres. On the Gunnison National Forest, there are about 7,000 infested trees with about half of them located in the West Elk Wilderness. On the Bighorn National Forest about 3,000 trees are infested on 2,000 acres. Scattered static infestations were located on the Grand Mesa-Uncompahgre National Forest.

Logging, trap-tree programs, and chemical measures are planned to suppress beetle outbreak except in primitive and wilderness areas, where no control is planned.

Mountain pine beetle, *Dendroctonus ponderosae* Hopk., has been a serious problem on about a quarter-million acres of stagnated, second-growth, and mature ponderosa pine stands in the Black Hills, Roosevelt, Pike, and Arapaho National Forests. The Black Hills National Forest and the South Dakota Department of Game, Fish, and Parks found about 30,000 infested trees on 250,000 acres with the general trend classed as static. The Roosevelt and Pike National Forests and Colorado continued to have scattered infestations along the Front Range with about 20,000 attacked trees.

Mountain pine beetle activity has increased in lodgepole pine near Granby and Hot Sulphur Springs, Colo. Timber harvest has controlled one epidemic center. Other infestations and new outbreak spots, which have killed 10,000 trees, showed up in stands near the lodgepole and sagebrush transition zone. The Northwestern Colorado infestation on BLM and State lands continued to kill small sawlog timber in an isolated stand.

Douglas fir beetle, *Dendroctonus pseudotsugae* Hopk., continued to be a problem in Douglas-fir stands on rough terrain in Colorado and Wyoming. Control action has been initiated in operable stands.

Other *Dendroctonus* beetles. Mortality of high-risk ponderosa pine caused by a complex of *Dendroctonus* bark beetles continued at a low level on the San Juan and Grand Mesa-Uncompahgre National Forests. The beetles responsible are mountain pine beetle, *D. ponderosae* Hopk., western pine beetle, *D. brevicomis* LeC., and roundheaded pine beetle, *D. adjunctus* Blandf.

Western spruce budworm, *Choristoneura occidentalis* Free., defoliation has increased from no observable defoliation last year to about 32,000 acres in 1970 on the San Isabel National Forest.

Other insects. A looper, *Lambdina* sp., defoliated oak on the White River National Forest. Western balsam bark beetle, *Dryocoetes confusus* Sw., continued to kill small groups of subalpine fir throughout Colorado and Wyoming. The lodgepole terminal weevil, *Pissodes terminalis* Hopp., caused terminal damage to sapling stands of lodgepole pine on the Routt and Roosevelt National Forests. In some regenerated areas, 50 percent of the terminals were destroyed.

Light to moderate defoliation on ponderosa pine in Montezuma and La Plata Counties in Colorado was caused by terminal damage from sugar pine tortrix, *Choristoneura lambertiana* (Busck); a pine tip moth, *Rhyacionia* sp.; and an unidentified associate needleminer.

A small infestation of sawfly believed to be the lodgepole sawfly, *Neodiprion burkei* Midd., was reported around Turquoise Reservoir near Leadville, Colo. The host is lodgepole pine and the extent of damage is unknown. The smaller European elm bark beetle, *Scolytus multistriatus* Marsh., associated with Dutch elm disease, has become a problem in American elms on the Bessey Nursery administration site in Nebraska.

SOUTHWESTERN STATES (R-3)[4]

By Robert H. Frye
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Conditions in Brief

The spruce and roundheaded pine beetles remained the most damaging pests in the Southwest. The spruce beetle infested 88,500 trees in 1970 on the Mt. Baldy area of Arizona. Seven

[4] Includes all forested lands in Arizona and New Mexico and National Park Service land in southern Colorado and western Texas.

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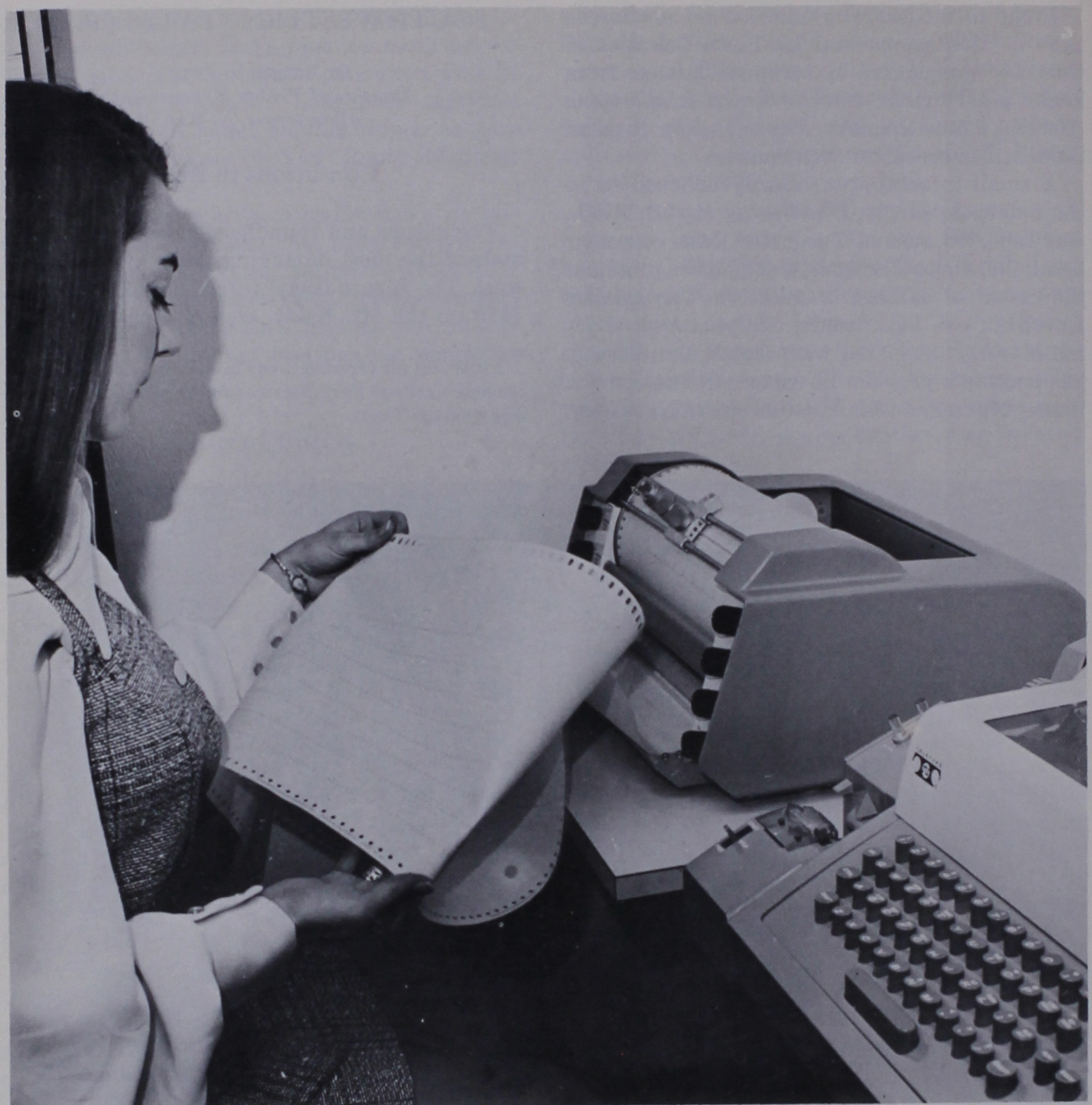
An abnormal spruce beetle egg gallery in a trap tree treated with cacodylic acid (left) compared to a normal egg gallery 5 weeks after attack (Santa Fe National Forest, N. Mex.).



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Printout from digital plotter and teletypewriter used in ADP spruce beetle presuppression survey, (Santa Fe National Forest, N. Mex.)

smaller infestations were scattered throughout the Region. The roundheaded pine beetle infested 250,000 ponderosa pine trees in 1970 on the Lincoln National Forest and Mescalero-Apache Indian Reservation. Chemical control was necessary on the Coronado National Forest, Ariz., to suppress a roundheaded pine beetle population in 1,100 trees at a high-use recreation area.

Defoliator activity was static. The Douglas fir tussock moth defoliated 400 acres of mixed conifer type near Globe, Ariz. Suppression efforts

will be necessary at Sabino Canyon, near Tucson, Ariz., against a tent caterpillar infestation. Western spruce budworm populations remained endemic.

Status of Insects

Spruce beetle, *Dendroctonus rufipennis* (Kby.), caused excessive volume losses of mature and overmature spruce at one major and seven minor outbreak centers in the Southwest. The major outbreak was east of Whiteriver, Ariz., in the Fort Apache Indian Reservation and the Mt. Baldy Wilderness Area, Apache National Forest. On the Reservation, 76,500 trees were infested in 1970 and 35,500 trees in 1969. This volume loss amounted to 27.5 million board feet. The inaccessibility of this virgin spruce forest prohibits immediate salvage. Logging and trap-tree programs are being conducted, but volume losses will be excessive. The severely hit Mt. Baldy Wilderness Area had 12,000 trees infested in 1970 and 3,000 infested in 1969.

In addition to the above area, seven smaller outbreaks are active—four in northern New Mexico and three in northern Arizona. The four in northern New Mexico are located on the Philmont Scout Ranch and on the Cibola, Carson, and Santa Fe National Forests. Beetle populations on the latter two Forests are being contained by logging and by burning of infested residual slash. The three outbreaks in northern Arizona are on the Apache and Coconino National Forests and on the North Rim of Grand Canyon National Park. Further deterioration of mature and overmature spruce forests of the Southwestern Region is expected.

Automatic data processing techniques were developed for presuppression survey printout maps. Graphic presentation was found to have more meaning and impact than the usual tabular data arrays with which land managers and administrators are confronted.

Trees treated with cacodylic acid within 4–8 weeks of peak spruce beetle emergence were evaluated as lethal traps. These trees were as effective in attracting spruce beetles as untreated, felled check trees. However, only a few insects survived in the treated trees, while significant survival was found in the check trees. Blue stain fungus was reduced significantly in treated trees. Half-strength cacodylic acid treatments were as effective as full-strength treatments in reducing spruce beetle survival and blue stain fungus. Further cacodylic acid pilot studies are planned for 1971.

Roundheaded pine beetle, *Dendroctonus adjunctus* Blandf., is epidemic on the Lincoln National Forest and the adjacent Mescalero-Apache Indian Reservation, east of Cloudcroft, N. Mex. Presuppression survey data showed 250,000 infested ponderosa pine trees on 80,000 acres. Attacks are primarily confined to overstocked two- and three-site class stands. Stand structure is thought to be the primary factor in the continuing epidemic trend.

A roundheaded pine beetle infestation at Riggs Lake, Coronado National Forest, near Safford, Ariz., is active on 640 acres. About 1,100 infested trees were felled and treated with ethylene dibromide in the fall of 1970 to protect the remaining trees in this high-use recreation area.

Engraver beetles, *Ips* spp. An Arizona five-spined engraver, *I. lecontei* Sw., continues to cause mortality of ponderosa pine on the Prescott National Forest. Supression efforts included the covering of slash piles with polyethylene sheeting. *I. lecontei* has infested large groups of pine that were felled by a rainstorm in the fall of 1970. Many standing trees have been damaged by rolling rocks or have exposed roots, and are probably susceptible to attack. Salvage operations will be directed toward reducing this hazard.

Potentially damaging populations of the pine engraver, *I. pini* (Say), were found on the Apache National Forest. Delayed slash disposal and thinning the year following logging operations initiated the problem. Infested trees were removed from the stand, and further silvicultural disturbances in the area have been delayed until the infestation subsides.

An infestation of *I. utahensis* Wood continued to top kill scattered, mature spruce on the North Rim of Grand Canyon National Park and the Kaibab National Forest. These trees are subsequently killed by secondary attacks from *Ips* or spruce beetles.

Breakage of pinyon pine, resulting from a heavy spring snowstorm, presented a high potential for a buildup of the California five-spined ips, *I. confusus* (LeC.), on the South Rim of Grand Canyon National Park. Breeding material in critical areas was disposed of by July. Ample breeding material was still available, but an expected population buildup did not develop for unknown reasons.

Southwestern tent caterpillar, *Malacosoma incurvum* (Hy. Edw.). Heavy populations of this pest caused severe defoliation of Fremont cottonwood, Goodding willow, and southwestern chokecherry in Sabino Canyon and Upper Bear Canyon, Coronado National Forest, near Tucson, Ariz. Tree mortality has not yet occurred, but branch kill and twig dieback were evident. Heavy caterpillar populations are expected again in 1971. Suppression with ground application of the bacterium *Bacillus thuringiensis* B. will be attempted in the spring of 1971 to protect the trees from further damage.

Western tent caterpillar, *Malacosoma californicum fragile* (Stretch), caused light to moderate defoliation of cottonwood on the Glen Canyon National Recreation Area, Ariz. Ground application of carbaryl in 1969 and 1970 helped to reduce the population of this insect. However, populations of the oystershell scale, *Lepidosaphes ulmi* (L.), have increased significantly and are causing some tree mortality. This is possibly due to the reduction of predators and parasites from spraying. If suppression is necessary in 1971, *B. thuringiensis* will be recommended.

Western spruce budworm, *Choristoneura occidentalis* Free., populations remained endemic in the Southwestern Region during 1970 and this trend should continue through 1971. Population monitoring will continue, on an annual basis, in stands with a past history of activity.

A southwestern pine tip moth, *Rhyacionia neomexicana* (Dyar), and an undescribed related species continued to cause height growth loss and stem deformity of ponderosa pine in central Arizona. Trend plots established in 1968 on the Sitgreaves National Forest indicate that the percentage of terminals infested has decreased from 82 percent in 1969 to 65 percent in 1970. However, recently planted areas are beginning to show significant tip moth damage.

Douglas fir tussock moth, *Hemerocampa pseudotsugata* McD. On Pinal Peak, south of Globe, Ariz., defoliation of a mixed conifer stand increased from about 200 acres in 1969 to 400 acres in 1970. Some trees were killed in 1970 by severe defoliation. Current defoliation is moderate to severe. A virus was detected in late instar larval samples collected in July. The 1970 fall egg mass survey indicates that the population is declining. Light to moderate defoliation is expected in 1971.

A pinyon needle scale, *Matsucoccus acalyptus* Herb., defoliated pinyon pine throughout the Region. The most damaging population is at Grand Canyon National Park. Tree mortality has resulted after several years of defoliation. Suppression may be necessary in the high-use recreation areas of the park.

Other insects. A small infestation of mountain pine beetle, *Dendroctonus ponderosae* Hopk., was suppressed by salvage logging on Carracas Mesa, Carson National Forest, west of Chama, N. Mex. This beetle caused scattered tree mortality of mature ponderosa pine on the Kaibab Plateau, Kaibab National Forest. Light infestations of the fir engraver, *Scolytus ventralis* LeC., killed scattered small groups of subalpine fir throughout the Region. Populations of the fall webworm, *Hyphantria cunea* (Drury), caused widespread defoliation of a variety of deciduous trees. An unidentified tussock moth, *Hemerocampa* sp., continued to defoliate boxelder in Whitewater Campground, Gila National Forest, near Glenwood, N. Mex. The alder flea beetle, *Altica ambiens* LeC., defoliated 300 acres of longleaf cottonwood along the Gila River near the Gila Cliff Dwellings. This infestation was on the Gila National Forest, National Park Service lands, and adjoining State and private land. A Nevada buck moth, *Hemileuca nevadensis* Stretch, is still present on native cottonwoods on the White Sands National Monument. The extent and activity of the Prescott scale, *Matsucoccus vexillorum* Morr., increased on ponderosa pine in northern Arizona.

SOUTHERN AND SOUTHEASTERN STATES (R-8)[5]

By J. D. Ward, D. R. Kucera and G. L. Downing[6]
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Conditions in Brief

Extremely low winter temperatures caused high mortality of southern pine beetle populations in the southern Appalachians and northern Alabama, but by midsummer populations had rebounded to damaging levels in western North Carolina and eastern Tennessee. Infestation in Texas continued to decline but remained a serious problem in some areas. A high infestation level developed in the summer and fall in Accomack County, Va., causing heavy tree mortality. Population levels increased in several areas of Louisiana and on the Homochitto National Forest in Mississippi.

Ips engraver beetles emerged from trees damaged by Hurricane Camille in Mississippi and spread to surrounding green trees causing large-scale tree killing. *Ips* were also aggressive in Louisiana, Texas, South Carolina, and Tennessee. The black turpentine beetle was active in association with engraver beetles in the Hurricane Camille area and was also responsible for heavy tree killing over a 96,000-acre area in the Sandhills of South Carolina.

Sawflies were generally more troublesome in 1970 than in 1969, particularly a Virginia pine sawfly which caused locally heavy defoliation in Virginia, Tennessee, Kentucky, and North Carolina. *Neodiprion taedae linearis* Ross was particularly active in Tennessee and Louisiana, while the redheaded pine sawfly was reported locally in Mississippi, Tennessee, North Carolina, Virginia, and Florida. Tree mortality occurred in Virginia after 3 to 4 years of heavy defoliation by *N. hetricki*.

The variable oakleaf caterpillar caused moderate to heavy defoliation of oak over 1.5 million acres in northern Arkansas. The forest tent caterpillar continued to defoliate widespread areas of water tupelo. In Louisiana, 477,000 acres were defoliated and in Alabama, 45,000 acres. Other infestations were reported in Kentucky and Florida. In Virginia, the fall cankerworm was controlled on 1,500 acres in a cooperative Federal and State project.

Other infestations include 131,000 acres of defoliation by walkingsticks in Arkansas and Oklahoma; detection of gypsy moth at three locations in Virginia; new infestations of balsam woolly aphid along the Blue Ridge Parkway and in the Great Smoky Mountains of North Carolina; and 50,000 acres of defoliation of live and post oak in Texas by a combination of two tortricids and a looper.

Status of Insects

Southern pine beetle, *Dendroctonus frontalis* (Zimm.). Extremely cold temperatures during the 1969–1970 winter caused more than 95 percent mortality of southern pine beetle broods in the Southern Appalachian Mountains and in northern Alabama.

Despite this drastic reduction in the overwintering population, a dramatic increase in numbers developed by late summer in several localized areas of western North Carolina and eastern Tennessee. Aerial reconnaissance and photographic surveys conducted by the USDA Forest Service's Division of Forest Pest Control revealed an expanding beetle population on the Tusquitee District of the Nantahala National Forest in North Carolina and the Tellico District of the Cherokee National Forest in Tennessee. The North Carolina Forest Service found similar conditions on adjoining private lands. Southern pine beetle populations were at a low level over other parts of the mountainous region in Tennessee, North Carolina, and Georgia.

There were several reports of scattered southern pine beetle infestations in the Piedmont and Coastal Plains of South Carolina, North Carolina, and Virginia.

The South Carolina Commission of Forestry reported a high level of beetle activity in York and Lancaster Counties during the late spring, but by fall the southern pine beetle population had subsided.

[5] Includes forested lands in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia.

[6] Entomologists at Asheville, N.C., Alexandria, La., and Atlanta, Ga., respectively.

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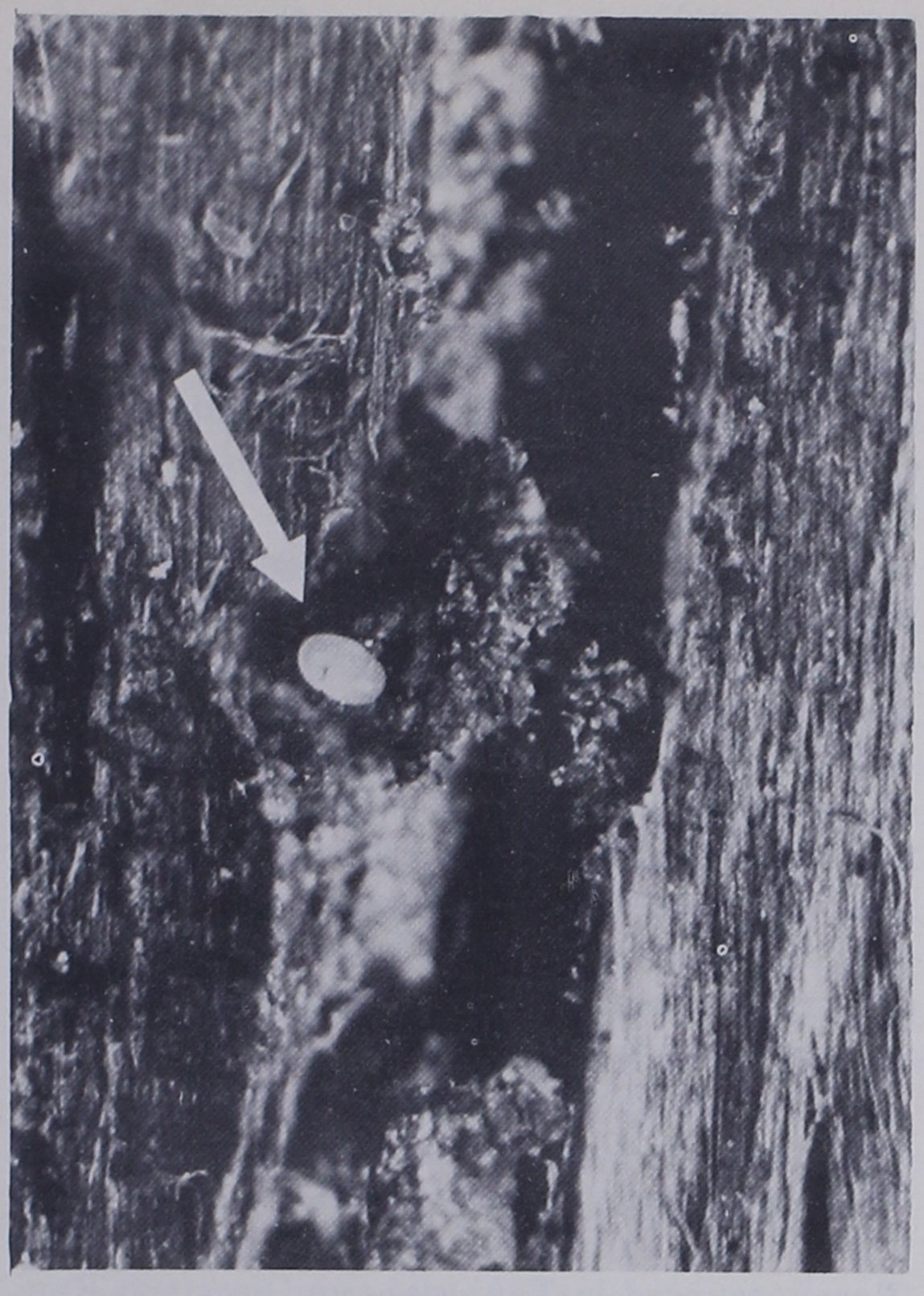
Walkingsticks defoliating understory vegetation on the Ouachita National Forest in Arkansas and Oklahoma.



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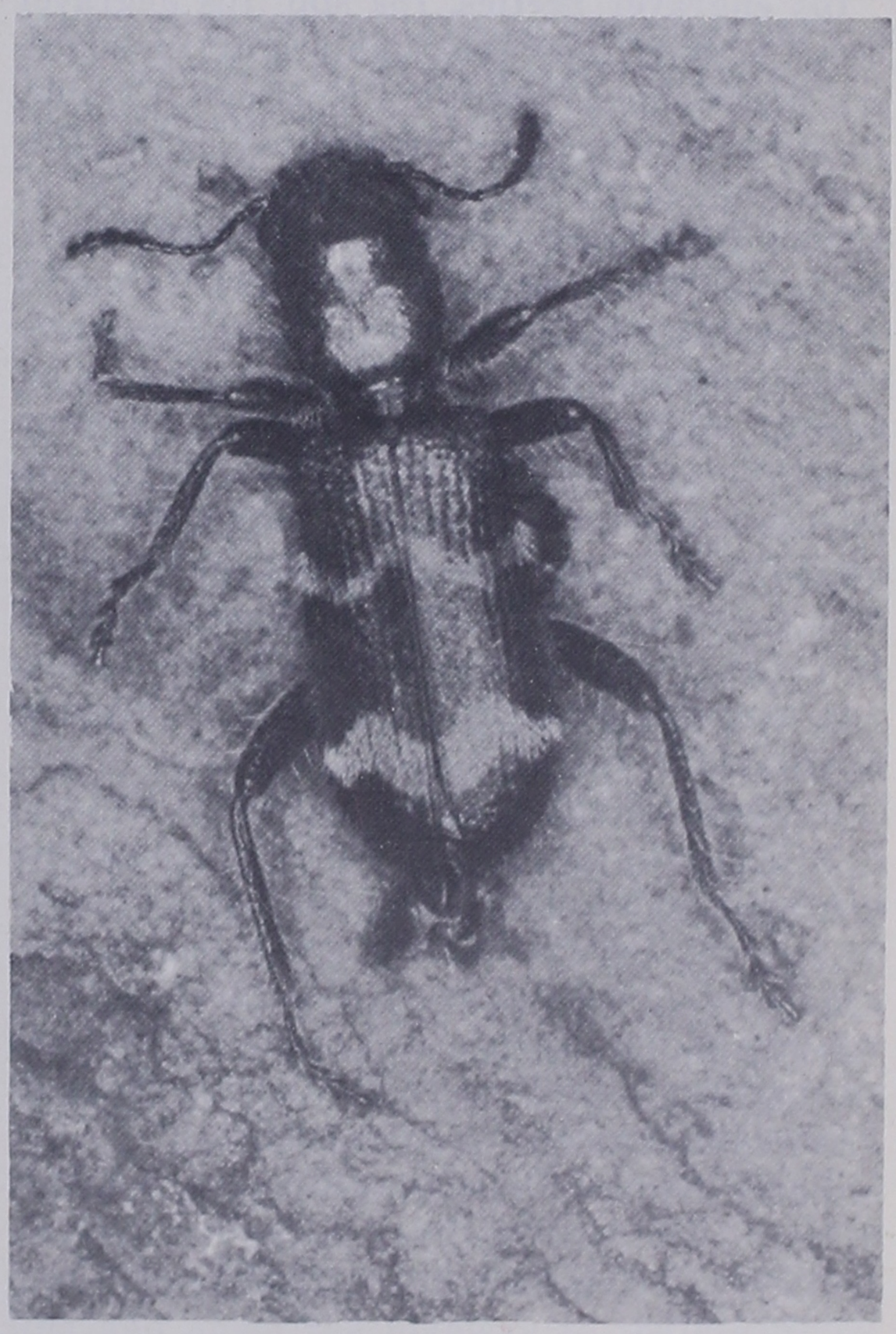
The egg stage of southern pine beetle (Nantahala National Forest, N.C.).

The Virginia Division of Forestry reported a sudden increase in beetle activity on the Delmarva Peninsula in Accomack County, Va., where more than 500,000 board feet in timber losses were attributed to the southern pine beetle. Increased southern pine beetle activity on the Virginia Peninsula was observed on the Colonial National Historical Park and Parkway during October 1970.

Activity also increased in Texas, Louisiana, and Mississippi. Midsummer infestations on the National Forests in Texas ranged from four to eight infested trees per thousand acres of host type with brood survival counts indicating a potential for increased activity. For the first time, the southern pine beetle was detected on the Neches District of the Davy Crockett National Forest. Activity continued at a moderate level in 1970 on private lands in Texas, but the total number of spots detected was less than half that of 1969. Although beetle populations were endemic on the Homochitto National Forest in Mississippi, brood counts were high, indicating a potential for increased losses in 1971. Southern pine beetles were not detected in areas devastated by Hurricane Camille. Populations did build up in north-central Louisiana and were epidemic on the Winn and Catahoula Districts of the Kisatchie National Forest. Epidemic populations were also found in three parishes east of the Kisatchie National Forest. Populations in other areas of Louisiana remained at an endemic level. Removal of infested trees by commercial sales continued in all areas of southern pine beetle activity. In general, southern pine beetle activity was well below that of 1969.



F–521045

A clerid beetle, *Thanasimus dubius*—a predator of southern pine beetle (Nantahala National Forest, N.C.).

Black turpentine beetle, *Dendroctonus terebrans* (Oliv.). An early spring buildup of the black turpentine beetle population was detected on the 96,000-acre Sandhills State Forest in South Carolina. By fall, mortality of attacked trees became evident with areas ranging in size from 200 to 300 dead and dying trees. This area of infestation was severely damaged by an ice storm in 1969 and the current beetle problem may have originated from conditions caused by the storm as well as severe stand disturbance due to vigorous salvage operations.

Elsewhere, infestation levels remained low except for a stand of pole-sized loblolly pine on the Kisatchie National Forest and the Hurricane Camille area of Mississippi. Scattered infestations were evident in logging units, especially in low, wet sites.

Ips engraver beetles, *Ips* spp. Ips engraver beetle activity increased significantly in southern Mississippi as a result of Hurricane Camille. Root-damaged trees and accelerated logging fostered this beetle buildup. Tree mortality occurred in the coastal towns of Gulfport, Bay St. Louis, and Biloxi, Miss. Where heavy equipment was used in debris removal, *Ips* infestations were exceptionally heavy. *Ips* activity was above normal throughout Louisiana, especially in Evangeline, Beauregard, and Natchitoches Parishes. Beetle activity near DeRidder required the cutting and burning of approximately 30 acres of a 15-year-old slash pine plantation. In Texas, moderate losses occurred in the spring and summer primarily as a result of drought conditions.

In South Carolina, *I. grandicollis* (Eichh.) and *I. calligraphus* (Germ.) caused considerable timber damage. Reconnaissance surveys conducted by the USDA Forest Service's Division of Forest Pest Control and the South Carolina Commission of Forestry showed heavy infestations on the Enoree Division of the Sumter National Forest and surrounding private land.

The Tennessee Division of Forestry found *I. avulsus* (Eichh.) activity in an area where all southern pine beetles were killed by sub-zero temperatures.

Pine sawflies. A Virginia pine sawfly, *Neodiprion pratti pratti* (Dyar), was the most widespread pine defoliator in the Southeast during 1970. Heavy infestations occurred in many sections of Virginia, Tennessee, Kentucky, and North Carolina. Nearly all of these States reported an increase in size and severity of infestation on State and private lands over last year. Also, heavy defoliation was observed on the George Washington and Jefferson National Forests in Virginia and the Daniel Boone National Forest in Kentucky.

Timber mortality was reported south of Bowling Green, Va., where bark beetles attacked previously defoliated trees. Heavy defoliation has occurred in this area for 3 consecutive years.

The Southeastern Forest Experiment Station of the USDA Forest Service in cooperation with the Virginia Division of Forestry introduced two hymenopterous parasites to aid in controlling this pest. Adults of *Monodontomerus dentipes* (Dalm.) and *Exenterus amictorius* (Panz.) were released in June. The Virginia Division of Forestry found that an earlier release of a cocoon parasite, *Dahlbominus fuscipennis* (Zett.), was established in several areas.

Scattered outbreaks of *N. taedae linearis* (Ross) occurred in Tennessee and western Kentucky. The Tennessee Division of Forestry reported this spring-feeding sawfly to be more widespread in 1970 than in 1969. Infestations were found from west Tennessee east to Chattanooga. Although no mortality has resulted from defoliation, more than 50 percent reduction was found in radial growth of heavily defoliated pines. Approximately 3,400 acres were defoliated by this sawfly near Georgetown, La. This infestation has been active for the past 20 years.

An outbreak of *N. excitans* Roh. caused light to heavy defoliation of longleaf and loblolly pines in Carteret, Pasquotank, and Davie Counties according to the North Carolina State Forest Service.

A heavy infestation of *N. hetricki* (Ross) was reported by the Virginia Division of Forestry in Caroline County. Several hundred acres of pole-sized loblolly pine have been severely defoliated for 3 to 4 years by this pest, and mortality is beginning to occur.

Scattered outbreaks of the redheaded pine

sawfly, *N. lecontei* (Fitch), were reported on National Forest land in southern Mississippi. A virus caused mortality before treatment was considered necessary. Several minor infestations were also observed in Tennessee, North Carolina, Virginia, Florida, and southern Louisiana.

An unidentified pine sawfly in Lowndes County, Miss., defoliated 16,000 acres of plantations in the spring. This infestation has been active for the past 4 or 5 years.

Variable oakleaf caterpillar, *Heterocampa manteo* (Dbldy.), Heavy infestations of the variable oakleaf caterpillar occurred north of Little Rock, Ark. Another defoliator, the saddled prominent, *H. guttivitta* (Wlk.), was associated with this caterpillar. The infestation covered 2.5 million acres with 1.5 million acres suffering moderate to heavy defoliation. This caterpillar is unique because it defoliates twice in a single year. The first defoliation occurred in the spring and the second defoliation culminated in mid-October. The red and white oak groups were most often defoliated. Southern slopes were more heavily defoliated than northern slopes.

Forest tent caterpillar, *Malacosoma disstria* (Hbn.). Extensive defoliation again occurred in southern Louisiana, especially in the Lake Maurepas and Morgan City areas. Partial to complete defoliation covered 477,000 acres of host type. Nearly pure stands of water tupelo were the most severely hit. This was the largest acreage defoliated since 1963.

Over 45,000 acres were defoliated in the Mobile and Tensaw River Basins of southwestern Alabama. Again, the most susceptible areas were pure to nearly pure stands of water tupelo. Of this, 24,000 acres were heavily defoliated. This area lies immediately north of Mobile.

Heavy infestations were reported on 1200 acres of oak type forest in western Kentucky by the Kentucky Division of Forestry, but the population was not as heavy as last year. A light infestation also occurred near Gainesville, Fla.

Nantucket pine tip moth, *Rhyacionia frustrana* (Comst.), infestations were common in several areas of the Southeast. The most severe infestation was on Atomic Energy Commission land at Aiken, S.C. Approximately 90 percent of the pines were infested in a 200-acre loblolly pine plantation. Other severe infestations were found in Callaway County, Ky., southwestern Virginia Counties, and in several pine plantations in middle and west Tennessee.

Fall cankerworm, *Alsophila pometaria* (Harr.). The fall cankerworm outbreak on the Wayah District of the Nantahala National Forest and the Coweeta Hydrological Laboratory in western North Carolina has subsided. No defoliation was observed during an aerial reconnaissance survey in June.

A cooperative suppression project involving the USDA Forest Service's Division of Forest Pest Control and the Virginia Division of Forestry to control an epidemic population of fall cankerworm was completed in May 1970. Good control was achieved over the 1500-acre area in Prince William County using .75 pounds per acre of Gardona in diesel oil, applied at the rate of one gallon per acre.

Walkingstick, *Diapheromera femorata* (Say). The walkingstick was again epidemic on the Ouachita National Forest of Arkansas and Oklahoma. Over 131,000 acres of hardwood forests were defoliated. Preferred hosts were white oak group, black locust, and black cherry. Heaviest defoliation was on northern slopes, especially the summits of higher mountains. This was the heaviest defoliation since 1963.

Balsam woolly aphid, *Adelges piceae* (Ratz.). Aerial surveys conducted by the USDA Forest Service's Division of Forest Pest Control in the Fraser fir type of the Southern Appalachian Mountains did not reveal any new areas of tree mortality in 1970. However, intensive trapping procedures in the previously established protection areas detected several new aphid infestations. The largest new infestations included 100 acres on Roan Mountain in Tennessee and North Carolina. Other new infestations were located on a 4-acre tract along the Blue Ridge Parkway between Mt. Pisgah and Soco Gap in North Carolina and along the highway to the Heintooga Overlook in the Great Smoky Mountains National Park in North Carolina.

Aphid populations increased on Spruce Mountain in the Great Smoky Mountains National Park and the Moses H. Cone Memorial Park on the Blue Ridge Parkway.

F–521047

Motile nymph of the balsam woolly aphid (greatly enlarged) found on slide trap in the Pisgah National Forest, N.C.

Gypsy moth, *Porthetria dispar* (L.). The USDA Agricultural Research Service, with the assistance of the Virginia Department of Agriculture, set approximately 6,000 survey traps in Virginia during July to detect this pest. One male moth was trapped in Rockingham County, one in Prince William County, and one in Accomack County. Aerial surveys conducted by the Virginia Division of Forestry in early July did not detect any defoliation by the gypsy moth in northern Virginia.

Deodar weevil, *Pissodes nemorensis* Germ. An infestation of the Deodar weevil was detected in an apparently healthy 12-year-old loblolly pine plantation near Robeline, La., in Natchitoches Parish. The infestation was detected in March 1970. An estimated 200 scattered trees (20–40 feet tall and 3–12 inches d.b.h.) were killed in the plantation. This is probably the first report of *P. nemorensis* as a primary causal agent killing pine of this size.

Seedling debarking weevils. Increased populations of pales weevil, *Hylobius pales* (Hbst.), and the pitch-eating weevil, *Pachylobius picivorus* (Germ.), were detected in the Upper Sandhills area of South Carolina in 1970. The South Carolina Commission of Forestry trapped over 6,000 adult pales weevils for the USDA Forest Service. These weevils were used by the Division of Forest Pest Control to rear adult weevils for the Forest Service Insecticide Evaluation Project in Berkeley, Calif., for use in insecticide screening tests.

F–521046

Pales weevil larva in white pine bolt (Nantahala National Forest, N.C.).

Other insects. Localized outbreaks of the periodical cicada, *Magicicada septendecim* (L.), were reported in North Carolina, Tennessee, Virginia, and Kentucky. This pest caused extensive twig and branch kill of hardwoods but no tree mortality was observed.

Increasing populations of a leaf mining weevil, *Odontopus calceatus* (Say), on yellow poplar were detected in scattered locations on the Central Peninsula State Forest in Tennessee.

The eastern tent caterpillar, *Malacosoma americanum* (Fab.), caused severe defoliation in most of the States in the Southeast. Although no timber mortality occurred, unsightly tents and

F–521051

Radiograph of bagworm bags showing egg masses (Pea Ridge National Monument, Ark.).

defoliation caused some concern in many recreation and scenic areas, particularly along the Blue Ridge Parkway in Virginia and North Carolina.

Damage by the locust leafminer, *Xenochalepus dorsalis* (Thunb.), was moderate to heavy in parts of Kentucky, Tennessee, and Virginia in 1970.

Two tortricids which defoliated 100,000 acres of live and post oaks in Lavaca and Colorado Counties, Tex., last year have been identified as *Archips semiferanus* (Wlk.) and *Sparganothis pettitana* (Rob.). An associated looper, *Nematocampa filamentaria* (Guen.), was found in smaller numbers. Defoliation in 1970 covered more than 50,000 acres.

The bagworm, *Thyridopteryx ephemeraeformis* (Haw.), killed many eastern redcedar trees near Opelousas, La., Defoliation was heavy at Pea Ridge National Military Park and Mountain View, Ark. The fall webworm, *Hyphantria cunea* (Drury), defoliated pecan and persimmon near Natchitoches, La. The larger elm leaf beetle, *Monocesta coryli* (Say), defoliated scattered elms in Johnson City, Tex. A leaf skeletonizer, *Bucculatrix* sp., defoliated over 8,000 acres of Nuttall oak in Mississippi.

NORTHEASTERN STATES (R-9)[7]

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Conditions in Brief

Forest defoliators continued to be the major pests in the Northeastern States. Hardwood defoliation increased in 1970 both in area defoliated and in the number of pests causing defoliation. Heavy gypsy moth defoliation was reported on about 1 million acres in New England and adjoining States. The forest tent caterpillar defoliated almost 2 million acres in Minnesota, 250,000 acres along the Ohio-West Virginia border, and 110,000 acres along the Maryland-Pennsylvania border. Nearly 3 million acres of aspen in the Lake States was affected by large aspen tortrix. The saddled prominent heavily defoliated about 1 million acres in New England and adjoining States and a small outbreak was reported in Michigan. Leaf rollers and leaf tiers fed on oak in Pennsylvania and neighboring States with some tree mortality reported. In Lower Michigan, a red humped oakworm severely defoliated about 275 square miles of oak type.

The spruce budworm continued to be the most important coniferous defoliator. The major outbreaks were in Maine and Minnesota, but localized defoliation has now spread to all the Lake States. Pennsylvania reported spruce budworm on hemlock.

Status of Insects

Gypsy moth, *Porthetria dispar* (L.). Heavy defoliation was widespread in the Northeastern States as shown by the following breakdown:

States	*Acres defoliated*
Connecticut	38,500
Massachusetts	14,000
Maine	10,000
New Hampshire	60,000
New Jersey	300,000
New York	430,000
Pennsylvania	15,000

Several States conducted control programs with carbaryl applied at the rate of 1 pound in 1 gallon of water per acre. In New Jersey, 100,000 acres was treated and in New York, 110,000 acres. In Pennsylvania, 3,000 acres was sprayed with Dylox followed with an application of carbaryl about 10 days later. Despite these control efforts, gypsy moth defoliation is expected to increase in 1971. The infestation in Michigan apparently has been controlled since no moths were recovered in 1970 traps.

Forest tent caterpillar, *Malacosoma disstria* Hbn. In Minnesota, about 400,000 acres of aspen

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[7] Report compiled from information submitted by Federal, State and private co-operators in Illinois, Indiana, Iowa, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, West Virginia, and Wisconsin.

[8] Entomologist at St. Paul, Minn.

was heavily defoliated and light defoliation occurred on another 1.5 million acres. The outbreak near International Falls is expected to continue for at least another year.

An extensive area along the Ohio River in West Virginia and Ohio showed 250,000 acres of maple and oak defoliated. About 110,000 acres of oak and maple was also stripped along the Pennsylvania–Maryland border.

Large aspen tortrix, *Choristoneura conflictana* (Wlk.). The area of heavy infestation by the large aspen tortrix in the Lake States increased considerably in size as well as distribution. In Minnesota, 1.75 million acres was estimated to be heavily to moderately defoliated, and another 1 million acres lightly defoliated. Scattered areas were also defoliated in northern Wisconsin and Upper Michigan. Further increases in defoliation are expected in 1971.

Saddled prominent, *Heterocampa guttivitta* (Wlk.). Infestations of the saddled prominent in the Northeast were heavy as shown in the following tabulation:

States	*Acres infested*
Massachusetts	125,000
Maine	12,000
New Hampshire	480,000
New York	89,000
Pennsylvania	50,000
Vermont	136,000

F–521054

The forest tent caterpillar heavily defoliated 400,000 acres of aspen in Minnesota.

The area of defoliation in New York has decreased, but elsewhere it has increased. In Michigan, about 7,000 acres was infested. This infestation has been present in part of this area for 4 consecutive years. On the basis of past outbreak history in other areas of the country, the population of these insects should decline in 1971.

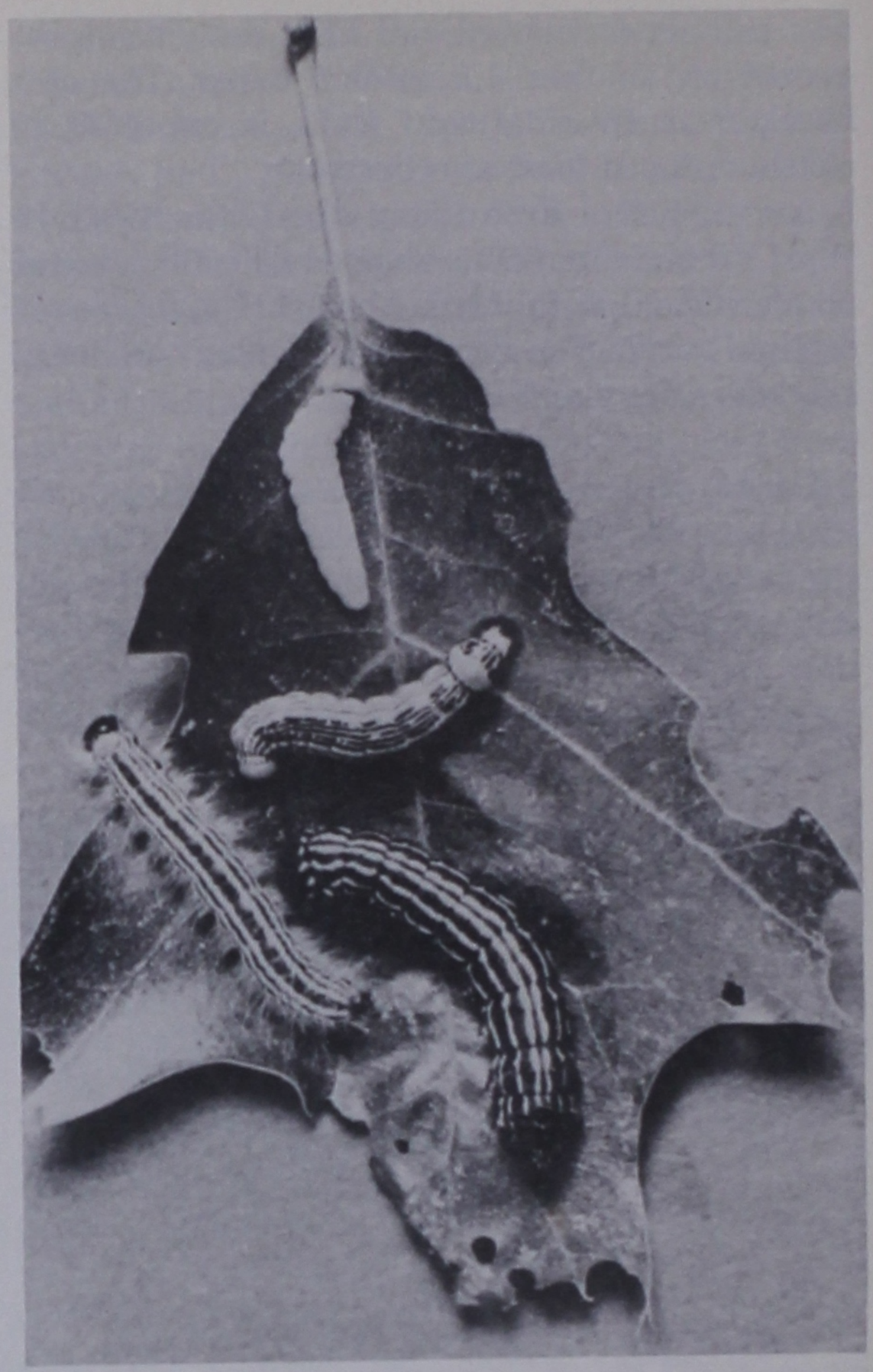
Leaf rollers and leaf tiers, *Croesia semipurpurana* (Kearf.), *Archips argyrospilus* (Wlk.), *Archips semiferanus* (Wlk.). Large acreages of oak were heavily defoliated in the Northeastern States by this complex, although one of the three species usually predominated in any one outbreak. *A. semiferanus* defoliated almost 1 million acres in Pennsylvania and caused scattered oak mortality on about 161,000 acres. Populations of the same insect in Michigan suddenly declined after about 4 years of heavy defoliation. Some oak mortality was also evident in this area.

The defoliator complex of *C. semipurpurana* and *A. argyrospilus* in New Jersey and West Virginia was widespread and frequently associated with cankerworm and/or gypsy moth outbreaks. More than 100,000 acres was defoliated in New Jersey, of which about 40,000 acres was treated by USDA Agricultural Research Service with insecticide as part of a gypsy moth control project. In West Virginia, about 100,000 acres was severely defoliated.

A redhumped oakworm, *Symmerista canicosta* Franc. About 275 square miles of oak was heavily defoliated in Lower Michigan, and approximately an equal area was lightly to moderately defoliated. Several other oak defoliators were associated with the primary pest. *S. canicosta* defoliation was also reported from scattered locations in Minnesota and Wisconsin.

Variable oakleaf caterpillar, *Heterocampa manteo* (Dbldy.). This defoliator was frequently associated with *S. canicosta* but in some areas it was the primary pest. Severe defoliation by this insect was reported on oaks in Missouri and in scattered areas of western Minnesota. A general population increase is expected for 1971.

Spruce budworm, *Choristoneura fumiferana* (Clem.). The spruce budworm outbreak near Oxbow, Maine continued, and another buildup appears to be developing in the Cross Lake-Madawaska Lake Area.



F–521055

The humped oakworm and its associated defoliators (Michigan).

The extensive outbreak in northern Minnesota continued for the fourth year. Although some westward spread of the defoliation was noted in 1970, indications are that the outbreak is beginning to decline. Severe defoliation is expected to occur in 1971 in localized areas. Spruce budworm has appeared in some areas where it has not previously been a problem. Local infestations on spruce and fir were reported in Wisconsin and Michigan. In Pennsylvania, hemlock stands were defoliated in the eastern part of the State.

Jack pine budworm, *Choristoneura pinus* Free. In general, jack pine budworm defoliation occurred in Lower Michigan and northwestern Wisconsin. Defoliation is expected again in 1971 in these two areas but no major increase is anticipated.

Larch sawfly, *Pristiphora erichsonii* (Htg). Infestations in Tamarack stands were common in Minnesota, where about 500,000 acres was defoliated. In Michigan and Wisconsin, defoliation was generally light, except for a few local outbreaks. New York reported sawfly defoliation in larch plantations. Larch defoliation was also reported from Pennsylvania and Maryland. Minnesota has initiated preliminary studies on the effectiveness of a sawfly parasite, *Olesicampe benefactor* Hinz., against this insect.

A pine looper, *Lambdina pellucidaria* (G.&R.). Visible defoliation by this looper was reported on 10,000 acres at Cape Cod, Mass. The looper is increasing in the Northeast, with populations also reported from Long Island, N.Y.

Pine tussock moth, *Dasychira plagiata* (Wlk.). Anticipated heavy defoliation by the pine tussock moth in northern Wisconsin and eastern Minnesota did not materialize. However, severe defoliation occurred on 600 acres in a new area in northwestern Wisconsin. Potential for increased defoliation in 1971 was indicated by the egg mass surveys in both Minnesota and Wisconsin.

Redheaded pine sawfly, *Neodiprion lecontei* (Fitch). Most sawfly activity occurred in Michigan and a few local infestations were reported in Wisconsin. Practically no heavy sawfly infestations occurred in Minnesota.

Saratoga spittlebug, *Aphrophora saratogensis* (Fitch). Adverse weather caused the spittlebug population to decline in Wisconsin. Suppression was planned for nearly 2,000 acres, but the area treated was reduced to 700 acres in northeastern Wisconsin. Some resurgence of spittlebug activity was indicated by preliminary scar-count survey data.

Southern pine beetle, *Dendroctonus frontalis* (Zimm.). This pest, common to the southeastern United States, was a problem on loblolly pine in Maryland and Delaware. Dry weather in the fall appears to have favored increased beetle activity in these areas. In Maryland, 12 trees per 1,000 acres of host type were killed by August 1970.

Arborvitae leafminer, *Argyresthia thuiella* (Pack.). Tree mortality was reported from Vermont after 4 consecutive years of defoliation. Maine reported its second consecutive year of defoliation.

Aspen blotchminer, *Lithocolletis tremuloidiella* (Braun). Discolored aspen trees from blotchminer activity were common over most of the northern part of the Lake States. Heavy damage occurred along the western half of the Michigan–Wisconsin border.

Bagworm, *Thyridopteryx ephemeraeformis* (Haw.). Damage to ornamental and plantation conifers was reported in Ohio and Illinois.

Balsam woolly aphid, *Adelges piceae* (Ratz.). The aphid has been a problem primarily in the coastal areas of Maine, but it appears to be moving into the northern and western parts of the State. Scattered tree mortality was reported from Vermont, but in New Hampshire the problem is declining.

Birch skeletonizer, *Bucculatrix canadensisella* Chamb. Browning of white birch was noticeable over most of northern half of the Lake States. Most of the browning was caused by the skeletonizer, but in some areas of Wisconsin browning was also caused by drought. Birch decline in some areas appears to follow skeletonizer defoliation. The bronze birch borer may also become a problem on the weakened birch.

Cankerworms. The fall cankerworm, *Alsophila pometaria* (Harr.), and the spring cankerworm, *Paleacrita vernata* (Peck), were associated with the gypsy moth in New Jersey, where the complex was treated with carbaryl on 80,000 acres. Cankerworm populations declined in Vermont and Maine except in a 1,000 acre outbreak area near Bristol, Maine. Populations in the St. Paul, Minn., area were reduced by spray-

F–521058

Protective bags of the bagworm, a pest of red cedar, white pine, and many ornamental species (Ohio).

ing last year and no serious problem was reported in 1970. Lower Michigan also reported a decline in cankerworm population. A parasite, *Bathyplectes sp.*, was abundant in some areas.

Cicadas. The periodical cicada, *Magicicada septendecim* (L.), (17-year locust), caused locally heavy damage in Maryland, Pennsylvania, Ohio, and West Virginia. Apparently, an annual species is causing heavy damage to aspen in a small area in eastern Lower Michigan.

Eastern tent caterpillar, *Malacosoma americanum* (F.), populations in the Northeast were generally lower in 1970 than in 1969, except in Missouri and Pennsylvania. Defoliation in Mis-

F–521056

Maple twigs damaged by cicadas in Michigan.

souri was exceptionally heavy on black cherry and other *Prunus* spp. in the St. Louis area and also in southern Missouri. Populations are expected to be high in Missouri in 1971. Pennsylvania reported a heavy outbreak in the southern half of the State.

Elm spanworm, *Ennomos subsignarius* (Hbn.). Heavy defoliation on about 40,000 acres was reported in Connecticut and Massachusetts. A localized outbreak in northern Wisconsin is declining.

Fall webworm, *Hyphantria cunea* (Drury). Heavy defoliation was reported in southern Ohio. Populations increased in West Virginia; in Missouri they are decreasing. The webworm was locally abundant in southern Michigan where it appears to be increasing.

Hardwood borers. The carpenterworm, *Prionoxystus robiniae* (Peck), and the red oak borer, *Enaphalodes rufulus* (Hald.), caused serious losses in the Northeastern States. A study in Missouri revealed nearly $500,000 in annual losses due to borers of living hardwood trees. The carpenterworm was responsible for about 60 percent of the damage.

F–521059

Larva of the carpenterworm, a serious degrader of oak (Missouri).

A hemlock looper, *Lambdina athasaria* (Wlk.). A local outbreak on several hundred acres near New Bedford, Mass., caused some hemlock mortality.

Introduced pine sawfly, *Diprion similis* (Htg.). Scattered local outbreaks were reported in northern Minnesota and northwestern Wisconsin. Most of the heavy defoliation was caused by second generation larvae.

Loblolly pine sawfly, *Neodiprion taedae linearis* Ross. Heavy infestations were reported from southeastern Missouri and scattered areas of southern Illinois. This sawfly population appears to be increasing.

Maple leafcutter, *Paraclemensia acerifoliella* (Fitch). Damage increased in southern Vermont, but declined in the northern part of the State.

Nantucket pine tip moth, *Rhyacionia frustrana* (Comst.). Severe damage continued in New Jersey; about 100 acres of pine were treated at Fort Dix. Populations in Cape Cod, Mass., have declined. Some damage was reported from southern Illinois and Missouri.

Oak skeletonizer, *Bucculatrix ainsliella* Murtf. Damage by the oak skeletonizer was common in the eight northeastern States. The damage should decline during 1971 in New England where many larvae failed to pupate. Many of the oaks in central Minnesota and along the Mississippi River in Minnesota and Wisconsin were damaged. Wisconsin collections indicated that the insect may be a closely related, but new species of *Bucculatrix*.

Orangestriped oakworm, *Anisota senatoria* (J. E. Smith). An infestation of the pest occurred at George O. White State Nursery in Missouri. The heavy feeding necessitated spraying with Sevin. Higher populations are expected in 1971.

Pine bark aphid, probably *Pineus strobi* (Htg.). The aphid is a pest of pine seedlings in many forest nurseries in the Lake States. Last year a forest nursery at Watersmeet, Mich., reported good aphid control with a release of convergent lady beetle, *Hippodamia convergens* (G-M). Exploratory studies in 1970 suggest that the lady beetle is a voracious feeder on a number of aphids in the Lake States. Indications are that a change in cultural practices may increase the effectiveness of the native lady beetle.

Pine needleminer, *Exoteleia pinifoliella* (Chamb.), was first recorded as a pest of Christmas trees in southern Michigan in 1968. The insect is now reported from four counties in Michigan.

Virginia pine sawfly, *Neodiprion pratti pratti* (Dyar). The upsurge of Virginia pine sawfly populations continued in West Virginia, Ohio, and Indiana. West Virginia reported new infestations in 12 counties during 1970. Indiana reported heavy defoliation in 5,000 acres of shortleaf pine plantations scattered throughout the southeastern portion of the State.

Walnut caterpillar, *Datana integerrima* G. & R. Black walnut and butternut were defoliated in the southern half of Minnesota.

White pine weevil, *Pissodes strobi* (Peck). Increased weevil activity was reported in Pennsylvania. Vermont reported weevil damage on Christmas trees. Metasystox® was tested in Maine for weevil control. Satisfactory control was achieved with hydraulic applications, but poor control resulted from aerial and mistblower treatments.

Beech scale and beech bark disease, *Cryptococcus fagi* (Baer.), and *Nectria coccinea* var. *faginata lahman,* Watson & Ayers. Tree mortality from these associated pests continues to spread in New England. A survey in Pennsylvania showed that the disease is common in the northeastern part of the State.

F–521057

Terminal leader of white pine damaged by the white pine weevil (Pennsylvania).

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